JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1852.

CIVIL ENGINEERING.

A Report of the Engineer in Chief of the Navy, on the Comparative Value of Anthracite and Bituminous Coals.

OFFICE OF ENGINEER IN CHIEF, U. S. N.,
February 24, 1852.

Commodore JOSEPH SMITH, Chief of Bureau of Yards and Docks.

SIR:—In compliance with your instructions, made in conformity to the orders of the Navy Department in June last, to test the comparative value of Anthracite and Bituminous Coals for the purpose of generating steam, I have the honor to report:

That on the completion of the pumping engine of the dry dock of the New York Navy Yard, I caused experiments to be made with Bituminous (Cumberland) and Anthracite (white ash) Coals; and also on the completion of the United States steamer *Fulton*, in January last, I made a series of experiments with the same varieties of coals; the condensed results of all which are herein given. In addition, I would also state, that the United States steamer *Fulton* has been on constant duty several days since the experiments were made, burning constantly *White Ash Anthracite*.

From a letter from her Chief Engineer, H. Hunt, Esq., detailing her performance for the first four days, I extract the following: "The engine worked as well as any I ever saw, but the boilers exceeded my calculations; with clean fires very *easily* keeping forty pounds, cutting off at half stroke *without blowers*. I will here predict that she (the *Fulton*) will do *more* service at *less expense*, than any steamer government will have in five years. Whilst she was out on the first four days I was in her, we were frequently shut off or cutting off to run slow, and turning around, running from one vessel to another, so no calculations could be made of her speed or slip of wheel. The furnace doors were *open full half the time, to keep steam down*, so much more fuel was used than necessary; but the nature of our service was such, that it could not be avoided."

In consequence of the ill health of the Chief Engineer, he was not able to return in her second trip; the results of her consumption of coal on that occasion, are therefore extracted from a letter written by the assistant engineer, S. McElroy, showing the following: "Running time with White Ash Anthracite, January 25 to 28, seventy-one hours. Total coal used, 69,480 pounds, average 992·6 pounds per hour." The above extracts are made, not because they are the most favorable which occur in the log, but as they show the action of the engine and boilers for *several consecutive hours*. Nothing can be smoother than the motion of the engine under ordinary running circumstances; and in relation to the generative power of the boilers, it is more difficult to keep steam *down* than up.

It is unnecessary to use the blowers for ordinary work, as the natural draft proves abundantly sufficient for twenty to twenty-five pounds of steam, with sixteen to eighteen turns; although they are undoubtedly of great value in cases of emergency, and necessary to the prompt and proper management of the fire room, with Anthracite Coal. The *Fulton* will have no difficulty whatever in making twelve knots in ordinary sea weather as long as the bunkers hold out.

A more extended series of experiments would undoubtedly be more favorable to the anthracite, owing to the fact that small quantities were put in the furnaces and almost entirely consumed while the engine was working; it being well known that a small body of bituminous coal will burn longer than the same amount of anthracite spread *thinly* over the grates.

The cost of the two kinds of coals used in the experiments were as follows, at the New York Navy Yard: anthracite $3·90 per ton, bituminous $5·65 per ton.

I have made no comparison of the relative costs of the two kinds of coal, as it may vary according to different localities and periods of delivery, and cannot therefore be considered a fixed element; but have confined the results entirely to their generating powers, deduced from the following experiments:

1. *Experiments with Bituminous Coal, made with the Boilers of the U. S. Steamer Fulton, at the New York Navy Yard, January*, 1852.

The temperature of the water in the boilers being at 38° F., and the temperature of the boiler room 18°, the fires were lighted at ten hours thirty minutes, A. M.

At eleven hours forty minutes, A. M., the temperature of the water was 212° F., and steam began to be generated at the atmospheric pressure. Time raising steam, seventy minutes. The temperature of the boiler room had now increased from 18° to 32° F. At eleven hours fifty-four minutes, A. M., the steam pressure in the boilers was thirty pounds per square inch above the atmosphere. Time of obtaining thirty pounds of steam, one hour and twenty-four minutes, from a temperature of 32° F. Up to this time there had been fed into the furnaces one thousand pounds of dry pine wood, equal to five hundred pounds of coal, and two thousand eight hundred and twenty-six pounds of (Cumberland) bituminous coal. Total, three thousand three hundred and twenty-six pounds.

The engine was now set in operation to work off all the steam which

the above amount of coal would generate, no more being fed to the furnaces. In fifty-three minutes the steam pressure was reduced from forty pounds to five pounds, and the number of double strokes of piston made from forty-one to seven, when the engine was stopped. During the time the engine was in operation, the steam was cut off at half stroke.

The engine consisted of one cylinder, fifty inches diameter, and ten feet four inches stroke. The space between cut-off valve and piston, including clearance, to be filled with steam per stroke, is 3·094 cubic feet. The calculation of the amount of water evaporated is made from the quantities of steam measured out by the cylinder, divided by the relative bulks of steam of the experimental pressures and the water from which it is generated.

The initial pressure of the steam in the cylinder is taken at one pound *less* than in the boilers. The space displacement of piston filled with steam, per stroke, is 70·448 cubic feet, to which must be added the above 3·094 cubic feet, making a total of 73·542 cubic feet.

Time.	Mean pressure above atmosphere, per square inch in cylinder.	Number of double strokes of piston made.	Cubic feet of water evaporated.
MINUTES.	POUNDS.		
6	32½	41	10·326
5	25	34	7·311
5	22½	32	6·483
5	19½	31½	5·879
5	16½	31	5·352
5	14	30	4·796
5	11½	26	3·797
5	9	23	3·075
5	7½	21	2·631
5	5½	12	1·393
2	4½	7	0·868
			51·911

Taking the weight of a cubic foot of sea water at 64·3 pounds, the total weight evaporated is (51·911×64·3)=3337·877 pounds. The boilers of the *Fulton* contained 82,000 pounds of water at the initial temperature of 32° F., which was raised to 212° F., and 3337·877 pounds of it evaporated by 3326 pounds of coal.

Now it requires five times and a half as much caloric to evaporate a given bulk of water from a temperature of 212° F., as to raise it to that temperature from 32° F. The quantity of fuel, therefore, expended in raising the water from the initial temperature to that of 212° F., compared to that expended in evaporating the 3337·877 pounds from that temperature, will be as (82,000×180°)=14,760,000 to (3337·877×990°)=3,304,498·23, or as 4·4666 to 1·000; consequently, $\frac{3326}{4·4666}=744·6$ pounds of coal were consumed in evaporating 3337·877 pounds of sea water, or 4·483 pounds of water per pound of coal. It was intended to have made, on the following day, an experiment, under precisely the same circumstances as above, with anthracite; but it was found impossible from the presence of *ice* to work the engine; the experiment was therefore only made so far as regards the time of getting up steam, with the following results, viz:

The fires were lighted with the same *quantity* and *kind* of wood, and

the same *quantity* of coal that had been used the day previous. At seven hours and twenty minutes, A. M., the temperature of the water in the boiler being 38° F., and that of the boiler room 32° F., with the natural draft, the temperature of the water at eight hours and five minutes was 212°, (steam,) and the boiler room 43° F. Time to generate steam forty-five minutes. At eight hours and twenty minutes, the steam pressure in the boiler was thirty pounds per square inch. Time of obtaining thirty pounds of steam from water at 38° F. was *one* hour.

With the bituminous coal, it will be seen that it required seventy minutes to obtain steam from water at the temperature of 32° F., while it only required forty-five minutes with the anthracite; being a difference of time in this respect of about thirty-six per cent. of the bituminous time.

The data for a comparison of the evaporative values of the coals was obtained by another experiment, as follows:

2. *Experiments with White Ash Anthracite, made with the Boilers of the U. S. Steamer Fulton, in New York Bay, January* 1, 1852.

This experiment was made with the steamer under way, while steaming with steady pressure of steam and revolutions of the wheel, as follows:

Steam pressure (*initial*) in cylinder per square inch above the atmosphere, twenty-five pounds; double strokes of piston per minute, twenty-one and one-third; cutting off at from commencement of stroke, three-eighths; consumption of coal per hour, 1800 pounds.

From the above data, there was filled per stroke 52·837 cubic feet of the space displacement of the piston, to which add 3·094 cubic feet of space comprised between cut-off valve and piston, making a total of 55·931 cubic feet of steam of twenty-five pounds pressure, which would be per minute $55{\cdot}931 \times 42\frac{2}{3} = 2386{\cdot}39$ cubic feet, and per hour 143,183·40 cubic feet. Dividing this last number by the relative bulks of steam of the pressure generated, and the water from which it was generated, we obtain $\frac{143183{\cdot}40}{684} = 209{\cdot}332$ cubic feet of sea water, which at 64·3 pounds per cubic foot, amounts to 13,460·047 pounds, evaporated by 1800 pounds of coal, or 7·478 pounds of sea water per pound of coal.

3. *Experiment with White Ash Anthracite Coal, made with the Boilers of the Pumping Engine at the United States Dry Dock, New York Navy Yard.*

A comparative experiment was made with the boilers of the pumping engine at the New York Navy Yard, in October, 1851, on the comparative advantages of anthracite and bituminous coals. All the conditions were as nearly alike as practicable. With the anthracite coal a combustion of 980 pounds per hour, evaporated a sufficient quantity of water to supply the engine with steam of twelve pounds pressure above the atmosphere, per square inch, for 425 double strokes of piston per hour, the steam pressures being alike in both cases; the economical values of the coals will be represented by the number of double strokes of piston made, divided by the quantity of fuel per given unit of time; or will be anthracite $\frac{425}{980} = 0{\cdot}4337$: bituminous $\frac{294}{1100} = 0{\cdot}2673$, or the anthracite is better than the bituminous in the proportion of $\frac{0{\cdot}4337}{0{\cdot}2673} = 1{\cdot}623$ to 1·000.

It is proper to remark, that these boilers were expressly designed for burning *bituminous coal.*

COMPARISON.

The coals used in these experiments were the kinds furnished by the agents of the government for the use of the United States Navy Yard and steamers, and was taken indiscriminately from the piles in the yard, without assorting.

The bituminous was from the "Cumberland" mines; the anthracite was the kind known as "White Ash Schuylkill."

From the preceding data, it appears that in regard to the rapidity of "getting up" steam, the anthracite exceeds the bituminous thirty-six per cent.

That in economical evaporation per unit of fuel, the anthracite exceeds the bituminous in the proportion of 7·478 to 4·483, or 66·8 per cent.

It will also be perceived, that the result of the third experiment on the boilers of the pumping engine at the New York Dry Dock, which experiment was entirely differently made, and calculated from the first and second experiments, gave an economical superiority to the anthracite over the bituminous of 62·3 per cent.; a remarkably close approximation to the result obtained by the experiments on the *Fulton's* boilers, (66·8 per cent.,) particularly when it is stated that the boilers and grates of the pumping engine were made with a view to burning bituminous coal, which has been used since their completion; while those of the *Fulton* were constructed for the use of anthracite. The general characters of the boilers were similar, both having return drop flues.

Thus it will be seen, from the experiments, that, without allowing for the difference of weight of coal that can be stowed in the same bulk, the engine using anthracite could steam about two-thirds longer than with bituminous.

These are important considerations in favor of anthracite coal for the uses of the Navy; without taking into account the additional amount of anthracite more than bituminous that can be placed on board a vessel in the same bunkers, or the advantages of being free from *smoke*, which in a *war*-steamer may at times be of the utmost importance in concealing the movements of the vessel, and also the almost, if not altogether, entire freedom from spontaneous combustion.

The results of the experiments made last spring on the United States steamer *Vixen* were so favorable, that I recommended to the Bureau of Construction, &c., the use of anthracite for all naval steamers at that time having, or to be thereafter fitted with *iron* boilers; particularly the steamers *Fulton*, *Princeton*, and *Alleghany*, the boilers for all of which were designed with a special view to the use of *anthracite*, and with the approval of that Bureau.

The *Fulton's* bunkers are now filled with anthracite, and the consumptions referred to in the engineer's report on that steamer show, during the short time she has been at sea, that the anticipated *economy* has been fully realized.

In view of the results contained in this report, I would respectfully recommend to the Bureau of Yards and Docks, the use of anthracite in the

several Navy Yards, and especially for the engine of the Dry Dock at the New York Navy Yard.

In conclusion, I desire the approval of the Bureau to make such investigations as my duty will permit, with regard to the *experience* of the durability of *copper* boilers, when used with bituminous or anthracite coal; which can be done without any specific expenditure.

The inquiry may prove highly important to the Navy Department, as the use of anthracite under copper boilers has been heretofore generally considered as more injurious than bituminous coal, and is consequently not used by government in vessels having copper boilers.

Respectfully submitted by your obedient servant,

CHAS. B. STUART, *Eng. in Ch., U. S. N.*

Letter of the Engineer in Chief of the Navy, in relation to Coals, addressed to the Chairman of the Committee on Naval Affairs.

OFFICE ENGINEER IN CHIEF, U. S. N.,
May 27, 1852.

SIR:—The Senate, by resolution, having called for my reports to the Navy Department, giving the results of several experiments to test the relative value of anthracite and bituminous coals for generating steam, and referred the same to the Committee on Naval Affairs, I have thought that the results obtained from additional tests and experiments, made in this country and England, would be of service to the committee, and trust that the importance of the subject, both to the interests of the government and of individuals, will be considered a sufficient apology, if any be needed, for the liberty I have taken in addressing you this communication.

It should be remembered that what is required to be known on this subject, is neither the absolute nor relative evaporation by coals under conditions that never occur in practice, (as too many experiments are conducted,) but the facts to be determined are, the results which can be obtained from them under the ordinary circumstances in which they are used in marine boilers.

With this view I have prepared the following tabular statement, showing the actual evaporation of water effected by bituminous and anthracite coals in the boilers of several naval steamers, and in those of some transatlantic and river steamers plying to and from New York the past few years.

This table, therefore, from being prepared with care from the steam logs of the different vessels, (those of the navy being on file in this office,) is of great value; more so, undoubtedly, than if the results had been obtained from a series of special experiments made under circumstances not normal to the practice, which results, therefore, must be extensively modified before they could be received for practical guides.

The table includes all the cases I have been able to obtain at this time, where the data were unexceptionable; it extends in most instances over a course of several years steaming, and the average evaporation thus obtained, although not equal sometimes to the maximum of special experiments, is, in my judgment, more entitled to confidence than any single experiment made with greater critical accuracy, but on too small a scale for trustworthy results.

Of the latter character, I should rank those of W. R. Johnson, Esq.,

made under the directions of the Navy Department, in 1843, in the Report of which he states that "on each sample of coal were made from one to six trials, according to the quantity furnished. The coal consumed in one trial never exceeded 1567 pounds—this being the greatest quantity which the apparatus could receive in the period allotted to each experiment, including the time required for cleaning out the residue, making the necessary adjustments, and preparing for a new trial. The total weight of coal consumed in the trials of evaporative power has been nearly sixty-two and a half tons; and the weight used, on an average, nine hundred pounds per trial"—being less, it will be seen, than half a ton per trial, or not three tons for the greatest number of trials made with any one kind of coal, not equal to a two hours' consumption of an ordinary sea steamer.

These experiments were not only very limited in their extent, but were made with a boiler entirely different in its construction from those in naval and sea steamers, and not at all adapted for that service, and cannot therefore be compared in value to the following practical tests, deduced from the consumptions of hundreds of tons of coals on each steamer named and in actual service.

Table of Practical Tests of Different Varieties of Coal.

Names of Vessels.	Trade.	Sea water evaporated from temperature of condenser (100 deg. Fahrenheit) by 1 lb. of bituminous coal.	Sea water evaporated from temperature of condenser (100 deg. Fahrenheit) by 1 lb of anthracite coal.	Remarks.
		pounds.	*pounds.*	
Michigan,	United States Navy,	*5·000		Fresh water.
Mississippi,	do. do.	†4·780		Sea water.
Spitfire,	do. do.	†4·870		do.
Engineer,	do. do.	‡4·531		do.
Alleghany,	do. do.	†5·600		do.
Iris,	do. do.	†5·180		Sea water & old flue boil.
Princeton,	do. do.	†6·666		Sea water and new boil.
Princeton,	do. do.	§5·372		do. do.
Princeton,	do. do.		7·554	do. do.
Princeton,	do. do.		6·639	Sea water and old boilers.
McLane,	U. States Treasury,		7·030	Sea water.
Bibb,	do. do.		6·030	do.
United States,	Transatlantic pack't		7·480	do.
Herman,	do. do.	†4·487		Sea water and old boilers.
Baltic,	do. do.		8·555	Sea water.
City of Pittsburg,	do. do.	†4·930		do.
New World,	Hudson River,		8·022	do.
Commodore,	Long Island Sound,		7·262	do.
Roanoke,	N. York & Norfolk,		6·554	do.
		10)51·416	9)65·116	
	Averages,	5·142	7·235	

From the averages of the above table, it will be seen that the econo-

* Pittsburg Coal. † Cumberland Coal. ‡ Virginia Coal. §Scotch Coal.

mical evaporation by the anthracite exceeded that by the bituminous in the proportion of 7·235 to 5·142, or about 41 per cent. of the latter.

In the experiments made on coals by Playfair and De la Beche, by order of the British Government, in 1848, I find eleven varieties of Welsh coals having a constitution almost identical with the nine specimens of various Pennsylvania anthracite, experimented on by Johnson, viz:—

	Welsh anthracite.	Pennsylvania anthracite.
Fixed carbon,	87·54	88·54
Sulphur,	0·79	0·05
Other volatile matter,	5·50	5·17
Earthy matter, &c.,	6·48	6·51
	100·31	100·27

The average evaporation of water by the Welsh anthracite and by the Pennsylvania anthracite was as follows:

Fresh water evaporated from a temperature of 212° F., by one pound of coal.

By Welsh anthracite, ... 9·263 pounds.
By Pennsylvania anthracite, ... 9·590 "

Thus far there is a very close agreement between the results obtained by the different experimenters from substantially the same coal—that coal being anthracite.

In the experiments of Playfair and De la Beche, above cited, I find three varieties of Welsh bituminous, three varieties of Scotch bituminous, and one variety of English bituminous, having a constitution almost identical with the five specimens of Maryland (Cumberland) bituminous coal experimented on by Johnson.

	Welsh, Scotch, and English bituminous	Maryland (Cumberland) bitumin.
Fixed carbon,	75·00	75·05
Sulphur,	1·47	
Other volatile matter,	14·55	15·45
Earthy matters, &c.,	8·97	9·49
	99·99	99·99

The average evaporation by the Welsh, Scotch, and English bituminous, and by the Cumberland bituminous, was as follows, viz:

Fresh water evaporated from a temperature of 212° F., by one pound of coal.

By Welsh, Scotch, and English bituminous, . . . 8·02 pounds.
By Maryland (Cumberland) bituminous, . . . 9·93 "

Here is a great discrepancy between the results obtained by the two experimenters on substantially the same coals; Johnson making the Cumberland bituminous better than the British bituminous in the proportion of no less than twenty-four and a half per cent. of the latter. Had a similar difference been found in the case of anthracite between the results of the two experiments, it might have been accounted for by a difference of boiler or method of conducting the experiments.

From an investigation of the two kinds of boilers employed, I am of opinion that though in their proportions separately different, yet in the aggregate they were equivalent; an opinion justified also by the equality of results obtained with anthracite.

The results, then, of Johnson's experiments are, that Cumberland bituminous exceeds the Pennsylvania anthracite in economical evaporation, four per cent. of the latter; while the results from the English experiments, on substantially the same coals, make the economical evaporation of the anthracite to exceed that of the bituminous over twenty-four per cent. of the latter.

I would here beg leave to remark that there were several important facts attending the experiments of Prof. Johnson, which, rightly understood, would greatly modify his results; and which facts it is absolutely necessary to consider in order to arrive at correct practical information. One of the most important of these is the rapidity of combustion, which is ordinarily measured by the number of pounds of coal consumed per hour per square foot of grate surface, the average quantity of which in marine boilers may safely be taken at fifteen pounds.

In Johnson's experiments, however, the consumption of Cumberland bituminous coal was at the rate of only 7·11 pounds, and of anthracite 6·43 pounds; an average of less than half the practical rate of consumption.

It is obvious, therefore, that the rapidity of combustion being an important element in determining the evaporative efficiency of different coals, that in any experiments made to ascertain this efficiency for marine boilers, the rapidity of combustion should be about the average of what occurs in actual practice at sea.

Again: the importance of the rate of combustion in effecting the results to be obtained from anthracite or bituminous coals, are well signalized in the following extract from a paper by Chief Engineer Isherwood, U. S. Navy, published in *Appleton's Mechanic's Magazine*, for October, 1851, page 621, viz:—

"In the combustion of bituminous coal, *time* is the important element, and a slow rate of combustion with low velocity of draft is necessary for obtaining high evaporative results, and for the following reasons, viz: The bituminous portion of the coal is volatilized and separated from the fixed carbon part at a lower temperature than is required for its ignition, that is, than is required for its chemical union with oxygen. In this gaseous state, occupying the furnaces and flues of the boiler, it can only be ignited by being mixed with atmospheric air at a sufficiently high temperature; the element of time is, therefore, doubly important; first, to allow the gases to become intimately mixed with the atmospheric air; second, to allow them to acquire the necessary high temperature. If now, by means of a powerful draft, the gases, having only the low temperature due to their volatilization, be driven so quickly through the flues and out of the chimney of the boiler as not to allow them time enough to acquire the proper temperature for combustion, and to have the proper mixing with the atmospheric air, a great loss of effect must inevitably follow.

"For the economical combustion, then, of bituminous coal in generating steam, there should be a slow rate of burning, or a small amount consumed per unit of time per unit of surface."

In the combustion of anthracite coal, however, the above general observations do *not* apply. Considering the principal portions of the anthracite to be fixed carbon, there will of course be no volatilization of bitumen

at a lower temperature than what is required for the ignition of the fixed carbon; the coal will consequently remain unchanged until the temperature is sufficiently high for its combustion, that is, for the combustion of its fixed carbon; a forced draft cannot, therefore, carry off the fuel before it is ignited, and in this view, velocity of draft is comparatively unimportant. Again, combustion with the anthracite is effected solely by the contact of the air with their solid surfaces; there is therefore no mixing to be done, and consequently no time required to do it in. Here, then, under two important conditions, great velocity of draft, which is highly detrimental to the economical combustion of bituminous, is unimportant in the combustion of anthracite coal."

Taking the above views to be correct, which it is believed they are, it will be perceived that the very *slow* rate of combustion used with the bituminous coal in Johnson's experiments, (a rate utterly out of question with marine boilers,) was in *the highest degree favorable for the development of the full heating power of the bituminous coal;* now as this rate of combustion is impracticable in marine engines, a very great correction for inferior results to be obtained by the faster rate of combustion must be made, in order to obtain their *practical value.* With the anthracite, the very slow rate of combustion used was positively a *disadvantage*, as it could not keep the *whole* mass sufficiently high to enable the fixed carbon to take up the oxygen of the air as fast as the latter entered; consequently it exerted, in a considerable degree, a *cooling* power.

Further, it is generally acknowledged that the quantity of *carbon* in coals is at least an index, if not a full measure of their practical heating power. This idea is entertained by Johnson himself, and is announced in his work on coals, published in 1850, pages 118, 123, and 124, viz:

"The British experimenters continued their analysis of the coals till every sample had been submitted to both proximate and ultimate determination. In the American experiments time was not allowed before the report was demanded, for extending the ultimate analysis to more than one-eighth part of the samples. From such trials as were made, the deductions which appeared to be authorized by a careful comparison between the constituents of the coals and their *evaporative efficiency* was, *that the latter depended upon the total amount of carbon in the coal.* If hydrogen had been, as many European chemists had contended, the more efficient element, weight for weight, then all highly bituminous coals ought to have presented a greater heating power than those of lower bituminousness."

"Both the American and British experiments concur in proving the *reverse of this to be the fact.*"

"This development finally *sets aside the old calculations about the relative heating powers of carbon and of the hydrogen in coals.* By the principle of that calculation, any coal having a high degree of bituminousness ought, in consequence of the large proportion of hydrogen in its bitumen, to possess a much higher heating power than any coal of lower bituminousness. *The reverse of this is true. The higher the bituminousness, or, in other words, the greater the proportion of volatile matter a coal contains, the less is its available heating power.* The fact has been pointed out in former publications of the writer, that when solid hydrogen (that being its state in coals) is converted by the effect of heat into gaseous hydrogen, it

requires for this change a large amount of heat, as experimentally proved in the manufacture of illuminating gas. The hydrogen thus brought to the gaseous state, assumes the same bulk at a given temperature, say 212°, as it will retain at the same temperature when converted into vapor of water under the atmospheric pressure; and consequently, unless we can suppose the capacity for heat of gaseous hydrogen, bulk for bulk, to be greater than that of the vapor of water, we can conceive no reason why it should give out more heat in combining with oxygen than it had taken up in being converted into gas. The British Commissioners refer to this view of the subject, but do not clearly express an opinion of its validity.

"Fortunately, their silence is of less importance, as their own experiments furnish abundant proofs of the correctness of the principle. In order more clearly to exhibit the independence of *hydrogen efficiency* in computing heating powers of analyses, we have placed in the above table the per centage of hydrogen found in each sample of coals. From this column the averages are deduced, and a glance will show, that so far as any law or relation is perceptible, the *coals of highest heating powers are those which have the lowest per centage of hydrogen.*" The table above referred to condensed from Johnson, stands as follows, viz:

	Hydrogen.	Carbon.	Steam by experiment.	Steam by calculation.
	Per cent.	*Per cent.*	*Pounds.*	*Pounds.*
Four coals, average, . .	4·13	74·15	7·78	8·03
Do. do.	4·30	76·63	8·35	8·37
Do. do.	4·57	79·67	8·65	8·60
Do. do.	4·88	81·06	8·89	8·75
Do. do.	4·17	85·68	9·17	9·25
Do. do.	4·55	88·12	9·50	9·51
Do. do.	4·47	88·99	9·75	9·75

"Thus the four coals having a heating power of 7·78, have excess of hydrogen 4·13; the four having heating powers of 9·17, have of oxygen in excess 4·17. It will also be noted that an intermediate class of coals having a heating power of 8·65, has a higher per centage of hydrogen than either of the above, viz: 4·57. This is as we might expect to find it, if the *hydrogen be truly without efficiency in the practical use of coal. Indeed, the hydrogen appears from the practical tests thus far adduced, no more to merit the consideration as an element of evaporative efficiency in coal, than an equal weight of silicia, alumina, oxide of iron, or other inert substance found in its earthly residuum or ash.*"

It appears to be difficult to reconcile the foregoing and well established facts, with the numbers given by Prof. Johnson as the results of his experiments on anthracite and Cumberland (bituminous) coals, the former containing 88·54 per centum of carbon, and the latter only 75·05 per centum, while he makes the latter *four per centum* better than the former, while it should have been as above demonstrated, the reverse in the proportion of 88·54 to 75·05, or eighteen per centum.

The results of the British improvements on substantially the same coals,

viz: containing relatively 87·54 and 75 per centum of carbon, gave for the former a greater efficiency of twenty-four and a half per centum, making a difference in the results of over twenty-eight per centum.

A large number of experiments and practical tests might be cited to further prove the greater efficiency of anthracite over bituminous coals, in proportion very nearly as the element of carbon was found; but they would swell this paper, now already too extended. I have therefore confined the comparison to a few experiments of admitted correctness, to illustrate the facts, and in conclusion would add, that I agree fully with the views expressed in Professor Johnson's report, "that for the purpose of steam navigation, therefore, the rank most important to be considered (in different coals) is in the order of their evaporative power under given bulks. This is obviously true, since, if other things be equal, the length of a voyage must depend on the amount of evaporative power effected by the fuel which can be stowed in the bunkers of a steamer, always of limited capacity. With this scale of value, however, must be combined the relative freedom from clinker, and the maximum rapidity of action; while the rapidity of ignition is of inferior importance, but may deserve some consideration where short voyages, frequent stoppages, and prompt commencement of action are demanded." All of which qualities I think have been from practical results found to be more fully combined in the white ash anthracite of Pennsylvania than any other known coal. I therefore fully concur in the opinion of Professor Johnson, expressed in his work on coals, published in 1850, page 160:

"In conclusion I may observe, that while these analyses demonstrate the high density and compactness of this coal, (anthracite,) fitting it for the purposes of steam navigation, for which these qualities, combined with great heating power, are of primary importance, they also show, that for the various arts and for domestic consumption, its properties are calculated to sustain the high character of the central coal-field of Pennsylvania, for the concentrated and durable heat which it furnishes, and the absence of those ingredients which might interfere with its useful application."

I have the honor to be, sir, with great respect, your obedient servant,

CHARLES B. STUART, *Eng. in Ch., U. S. N.*

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*Law Expenses of Railways in Great Britain.**

The Court of Common Pleas was asked the other day to grant a rule calling on the Master to review his taxation of plaintiff's attorney's bill, in the case of Edwards and another, assignees of Parker, *v.* the Great Western Railway Company. The Court appears to have been much moved at the application.

In that bill a little item (among others) of £1300 occurred as the charge for the "notice of action." It seems the Master had knocked off £1000 of it, leaving the odd £300 to be charged. Now £300 seems to our sim-

* From Herapath's Journal, No. 678.

ple mind pretty fair for the mere preliminary step of a "*notice* of action." When all the gold from California and Australia comes, perhaps we might be more liberal in our notions; but as long as gold remains as dear as it is, we fear we shall never think of a "notice of action" costing £300 without shuddering; and yet the £300 is less than a fourth of the sum charged. The Chief Justice was, however, as illiberal in his remarks as we are, for he said that even "the allowance made by the Master (£300) was overmuch."

This notice of action had taken *three years to prepare;* had occupied no less than *ten clerks;* consisted of *forty-one folio volumes;* and the time consumed in work upon it was 6666 *hours!!!*

Before the "notice of action" came to light, we thought the most wonderful thing in the railway world was an act of incorporation for one company costing £600,000. But the "notice of action" completely takes "the shine out" of that.

We trust the 41 folio volumes of the "notice of action" will be carefully preserved. The Great Western Railway Company, the unfortunate party on whom the "notice" was served, should have them handsomely bound, and on the back of each have it labelled in gilt letters—"Notice of Action by one of the carriers on the line." We do not know whether the Great Western Company have any book-case large enough to contain all the folio volumes; if not, we think we know a party who would be very glad to provide, *gratis*, a place for them—the Great Exhibition Company. Mr. Russell could not confer on a brother railway Chairman a greater boon than to allow Mr. Laing the loan of these volumes of notice of action, for public exhibition in his Crystal Palace. We are confident it would draw a vast concourse of sight-seers to Sydenham.

Mr. Russell cannot be expected to give outright the notice of action to his railway friend. It has, at the much reduced price, cost the Great Western an enormous sum—£300, or more than £7 a volume; the original, but disallowed charge, having been £1300, or about £30 a volume. It is true, that costly as this library is, the intrinsic value of it is just about as much as the purchaser of waste paper would give for it.

> "The proper price of a thing
> Is just as much as it will bring."

Although "the notice of action" might be nothing but waste paper in intrinsic value, yet, if it will "show" and attract a great many to the new Crystal Palace, it has a value which it is difficult to estimate. Therefore, the Great Western may not have been forced into an expenditure so unproductive as at first sight appears. On the contrary, if Mr. Laing's Crystal Palace Company be favored with the loan of it, the Great Western ought to be paid at least good interest upon the outlay; and if Mr. Laing should not have it, then possibly a show room at the Paddington station could be fitted up, and derive to the Great Western Company a large income at the small charge of only a penny a peep. Scarcely a passenger on the crowded Great Western Station would object to give a penny to see what the 41 volume "notice of action" was like.

*Lackerstein's Patent Carbonic Acid Gas Engine.**

Mr. J. F. Lackerstein has patented some improvements in obtaining motive power, which consist of certain combinations of means and apparatus for obtaining power by the use of carbonic acid gas. The apparatus employed for generating the gas, and bringing it to a fit condition for use in the engine, consists of three vessels—a generator, a purifier, and an expander. These vessels are each of a cylindrical form, with hemispherical ends, and are connected with each other by suitable arrangements of pumps and pipes. The materials from which the gas is obtained (and which the patentee prefers to be sulphuric acid and carbonate of soda in solution, or other equivalent materials yielding residuary products of commercial value,) are pumped in atomic proportions into the generator, and caused to combine intimately by traversing a percolator filled with broken glass or other such materials, whereby an extended surface is obtained. After passing through the percolator, the used materials are collected at the bottom of the vessel, and discharged from time to time by means of a self-acting float valve, which rises from its seat when the liquid has attained a certain level, and falls again and closes the exit orifice when, by the discharge of part of the liquid, the level of the liquid in the generator is reduced. In order to prevent the float being crushed by the pressure of the gas, it is perforated at the top, whereby gas is admitted, and the interior filled at the same pressure as exists in the generator. The falling liquid from the percolator is prevented from entering the float by a shield, which serves to disperse it, and keeps it from contact with the open part of the float. The gas produced in the generator is pumped into the purifier, where it is passed through water, and from which is supplied to the expander by a double plunger pump of a peculiar construction. The expander is surrounded by a jacket in which steam, hot air, or hot water is caused to circulate, and the pressure of the gas is thereby much increased, or the use of a current of electricity may be adopted for the same purpose. From the expander the gas passes to the cylinder of the engine, where it actuates a piston in precisely the same manner as steam is caused to act on the piston of a steam engine. After performing its duty in the cylinder, the carbonic acid is passed through a vessel, containing in solution some chemical substance, capable of combining with it to form a material, which on being concentrated or evaporated to dryness, may be again used in the production of carbonic acid gas. Those portions of the apparatus which are liable to be corroded by the acid employed, are to be protected by a covering of gold or platina, or to be formed of those metals. With the same view, the interior of the generator is lined with sheet lead. Although sulphuric acid and carbonate of soda are the substances which the patentee prefers to use for producing gas for the purposes of his invention, he does not confine himself thereto, but uses bi-carbonates and sesqui-carbonates of soda, and carbonates of other alkalies and other acids than sulphuric, as also substances with an acid reaction; the object which he has in view being to obtain at the same time with the production of gas residuary

* From the London Mining Journal, No. 877.

materials of commercial value. Thus, from sulphuric acid, and carbonates of soda, potash, or ammonia, are obtained residual sulphates of those bases; from nitric acid with the same bases, valuable nitrates; from boracic acid and soda, the borax of commerce; from alum, with potash or soda, valuable fertilizing salts; from chromic acid and potash, chromate of potash, a compound valuable in dyeing; and from hydrochloric acid and ammonia, sal-ammoniac of commerce. These, however, are merely given as examples.

Claims.—1, The employment of the specified materials when corrosive acids are used, in the construction of the pumps and other parts of the apparatus. 2, The use of a percolator, whereby the materials forming the gas are more intimately mixed together by passing through a more extended surface. 3, The self-acting float valve, whereby the residuary matters collected at the bottom of the generator are discharged from time to time. 4, The purifier, whereby the carbonic acid gas is purified before being used, to prevent any injurious effect on the engine. 5, The pumping the gas into the expander, to increase its pressure by the action of heat previous to its being used in the engine, whereby greater economy is obtained in the consumption of the gas. 6, The heating and expanding of the gas for the last mentioned purpose by means of electricity. 7, The construction of a double plunger pump, which, requiring no valve, is particularly adapted for all aëriform and gaseous fluids, which require to be compressed or condensed under strong pressure, the mechanical arrangements of which are above described.

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*Trial of Parsey's Compressed Air Locomotive.**

Mr. Parsey having completed an engine on his principle, a successful trial took place on the Eastern Counties Railway on Tuesday last. Being the first experiment, to avoid accident, and by particular request, the compressed air was worked at a low density. The small engine, adapted to the narrow gauge, started from the Stratford station, and on reaching Lea-bridge was reversed, and came back to the Stratford station, a distance of four miles. Mr. Parsey drove her himself, assisted by his son, and was accompanied on the engine by Mr. Trevethick, Mr. Ashcroft, and another officer of the company, Mr. Box, proprietor, and two others, in all eight persons. A pilot engine, with persons connected with the railway, followed the compressed air engine, to witness the trip. The effect of an engine running on the rail without heat or steam was extremely novel and imposing.

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Sir:—I am unable to give the result of further experiments to that which took place on the 25th of May, as certain arrangements for that purpose have caused an unexpected delay. In the meantime, valuable data afforded by the first trial may not be unacceptable to your readers and the proprietors of railways.

The capacity of the reservoirs is 39 cubic feet, and were charged up to 11 atmospheres=165 lbs. per square inch. The regulator of the piston

* From the London Mining Journal, No. 875–877.

was set at starting at 20 lbs. As the engine with this limited charge of air and working pressure took 1760 revolutions of the 4-feet driving wheels in running four miles, the capacity of the cylinders being 180 cubic inches=4 cylindersful each revolution, would use 183 feet of air at some density; and as we had 429 cubic feet of atmospheric air only in the reservoirs, 183÷429, gives 2·3, or less than 1¼ atmospheres for the density of the 183 feet blown off, or about 18 lbs. per inch on the pistons. On the average, the working pressure could never have exceeded 18 lbs., as there was some power remaining on her return. The pistons being 2·5 diameter, equal to 5 inches in area, with less than 20 lbs., drove the engine and eight persons on it (2 tons besides the wheels) at the rate of eight miles per hour with the brake on, heavily pressed upon by the superincumbence of the eight persons pressing down the light springs, and crushing the brake upon the wheel, fixed on the centre of the crank shaft. This had been adjusted while the engine was free of the weight of the passengers. The consequence was an oversight, which, however, proved the power to be equal to the obstacle to starting and a fair speed.

As 400 cubic feet of atmospheric air drove the engine, &c., 4 miles, it is evident 100 feet drove her 1 mile. Now, as nothing could be said against my engine, it has been industriously circulated (before the experiment took place) that the cost of power would be prejudicial to the use of air engines. There is evidence existing that the Portable Gas Company compressed 1000 cubic feet per hour with a 10 horse power engine. It is well known that 3 lbs. of coal per horse power per hour is the outside expense of working stationary engines; consequently, as 30 lbs. compresses 1000 cubic feet, 1 ton or 2240 lbs. would compress 74,666 cubic feet of air, costing 8s. or 10s. at most; and as 100 feet drove the experimental engine 1 mile, that quantity would drive her and a carriage 746 miles for that cost.

A. Parsey.

Oxford street, June 10.

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*Speed and Fares on the Great Western, and London and North Western Railways.**

It appears from a comparison of the speed and fares of the express trains upon these railways, that the speed of the fastest trains between London and Bristol on the Great Western is 43 miles per hour, and on the London and North Western, between London and Birmingham, 40 miles per hour; the difference in favor of the former company being 3 miles per hour. The speed of all the mixed trains between London and Plymouth, and London and Liverpool, is 35½ miles per hour on the Great Western, and 36½ miles on the London and North Western—being 1 mile per hour in favor of the latter. The average fares per mile on the Great Western are—for first class, 3·068*d.*, and for second class, 2·502*d.*; while on the London and North Western the average is, for first class, 2·676*d.*, and for second class, 2·178*d.*; showing a difference in favor of a passenger traveling by the London and North Western Railway of

* From the London Civil Engineer and Architect's Journal, July, 1852.

0·392*d.* for first class, and 0·324*d.* for second class. A comparison of the time occupied and fare charged on a journey of 246¾ miles on both lines, shows a difference in time in favor of the London and North Western of 34 minutes by a first class train, and of 12 minutes by a mixed train; and also at the same time a saving of 8*s.* 1*d.* for that distance by the first class, and of 6*s.* 8*d.* by the second class; the fares on the Great Western Railway for first class being 63*s.*, and for second class 50*s.* 6*d.*; while on the London and North Western the fare for the first class is 54*s.* 11*d.*, and for the second class 43*s.* 10*d.* By the mail trains, the average speed per hour is 25 miles on the Great Western, and 28 miles per hour on the London and North Western; the difference in favor of the latter being 3 miles per hour. The average fares per mile on the former railway amount to 2·724*d.* for first class, and 1·867*d.* for second class; while on the latter railway they amount to 2·419*d.* for first class, and 1·775*d.* for second class; showing a difference in favor of the latter of 0·315*d.* for first class, and 0·092*d.* for second class. A comparison of the time and fares calculated on a journey of 246¾ miles, shows a saving in favor of the London and North Western of 58 minutes, and of 6*s.* 3*d.* in first class fares, and 1*s.* 10*d.* in second class fares. By the ordinary trains, the average speed per hour on the Great Western is 25 miles, and on the London and North Western 26¼ miles, being 1¼ mile in favor of the latter. The saving in the first class fares being 0·583*d.*, and in second class fares 0·291*d.* per mile also in favor of the latter company. A comparison of the time occupied on a journey of 246¾ miles, shows a difference in favor of the London and North Western of 21 minutes, the time occupied by the Great Western trains being 9h. 53m.; by the London and North Western, 9h. 32m. The saving in the first class fares is 12*s.* 4*d.*, and in the second class fares, 6*s.* 1*d.* in favor of the latter company.

For the Journal of the Franklin Institute.

Remarks on Incrustation in the Boilers of the Steamship Isabel.

A few weeks since, the steamship *Isabel* came into this port for repairs of hull and machinery, and to replace her boilers. The boilers have been removed, and are now being cut up; an opportunity has thus been afforded to obtain the accompanying specimens of scale from her boilers, which in the opinion of the writer, show an extraordinary degree of ignorance or negligence on the part of those persons having charge of her machinery.

If we are not mistaken, this vessel commenced her service in the winter of 1848, and the boilers have therefore been in use three and a half years; the ship plying semi-monthly between Charleston, Havana, and Key West. She is under steam an average of sixteen days per month, for ten months in each year; consequently, the boilers are now to be replaced, after about 600 days' service. The vessel being laid up for two months in each year, for a general overhaul and repair, it is to be supposed that *at such times at least* the scale is removed; in fact, the number of laminæ in one of the pieces forwarded agrees with this supposition; therefore, this accumulation, estimated to amount to about a ton, has

been deposited in less than a year. It is commonly asserted, to exculpate careless engineers, that the water in the vicinity of coral reefs holds in suspension, in addition to the usual constituents of sea water, a quantity of carbonate and sulphate of lime. I am not aware that this assertion has been proved by an analysis of those waters; but an experience of four years on board steamships in the Gulf of Mexico, satisfies me that no accumulation of scale to exceed one-sixteenth of an inch need be made.

These boilers have common return flues, and there could have been no difficulty in cleaning them, if inadvertently in a careless moment a small deposition had been made; but unfortunately, many engineers confine their attention to the interior of the furnaces and flues, to the neglect of the interior of the boiler.

The scale averaged three-eighths of an inch thick over the shell, and upwards of half an inch on the flues and connexions; in some places not less than four inches thick; the greatest deposit in the vicinity of the back connexions, where it hung pendant like stalactites.

There can be, I think, no doubt but that this extraordinary accumulation was caused by neglecting to blow, and carrying the water at a density approaching saturation. The loss occasioned by this neglect, independent of that caused by the short term of duration of the boilers, cannot be estimated at less than fifty per cent. in fuel; and we can only attribute their exemption from collapse to the thorough manner in which they are braced, and to the fact that the engines were short of steam, and worked it off with such rapidity as to keep the pressure below the point necessary to collapse red hot flues.

Specimen No. 1. Taken from over the furnace; iron in contact with it much injured, and showing evident marks of having been overheated; half an inch in thickness.

No. 2. Taken from an angle of the furnace, at the entrance of the flues; this specimen is completely vitrified; five-eighths thick.

No. 3. Taken from the vertical portion of the shell, adjacent to the furnace; this specimen has not been in contact with red hot iron, and presents an entirely different fracture and appearance; five-eighths in thickness.

No. 4. Taken off a flue at the back connexions; presents a crystalline fracture, and marks of having been subjected to great heat; one inch and a quarter in thickness.

Note.—The specimens sent by our correspondent, are as usual, sulphate of lime, for the most part crystalized. We do not know that waters from the vicinity of coral reefs have been analyzed, but we have published in our Journal, (Vol. xiv, p. 297, 3d Series, for instance,) accounts of the formation of scale in the boilers of steamers navigating those waters, which show a very great amount of the sulphate of lime in such waters. It would seem that the scale will form very rapidly, and in fact, theory will indicate the same thing, on account of the insolubility of sulphate of lime in hot water. Blowing at short intervals of time appears to be unavailable to prevent the formation of scale, but certainly these facts will not justify the formation of stalactites. Every one who sees the specimens now sent, will at once admit that they indicate very gross negligence on the part of those in charge. Editor.

AMERICAN PATENTS.

List of American Patents which issued from Aug. 10th to Sept. 7th, 1852, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

15. For an *Improvement in Processes for Making Illuminating Gas;* Henry W. Adams, City of New York, August 10.

Claim.—"What I claim as my invention is, the process of manufacturing illuminating gas, substantially as herein set forth, the process of feeding into heated retorts charged with bituminous coal, either oil, coal tar, resin, or asphaltum, or any other bituminous or carbonaceous substances, separately or mixed, and reduced to a fluid state, and decomposing the same in the same retort, and by the use of the same heat, in conjunction with the distillation of the coal, in the manner and for the purposes substantially as herein described."

16. For *Improvements in Double Gates;* J. S. Brown, Washington, D. C., August 10.

Claim.—"What I claim as my invention is, the arrangement of the forked rods, or their equivalents, in combination with the inclined track and roller, for the purpose of causing the gate always to swing in the direction from the rider, substantially as herein set forth.

"I also claim the combination of the latch, catch, and pin, or their equivalents, substantially in the manner and for the purpose herein set forth."

17. For an *Improvement in Casting Type;* William P. Barr, Assignor to George Bruce, City of New York, August 10.

Claim.—"What I claim as my invention is, the employment in type casting machines of an adjustable valve, substantially in the manner described."

18. For an *Improvement in Cider Mills;* Jarvis Case, Selma, Ohio, August 10.

Claim.—"Having fully described the nature and operation of my invention, what I claim as new is, the employment of the revolving crushing cylinder or roller, with grooves cut in its periphery, the movable feeding slats or radial cogs, the eccentric rings or plates, and the scrapers, the whole being constructed, arranged, and operating in the manner substantially as and for the purpose herein set forth."

19. For an *Improvement in Machines for Drilling Stones;* Henry W. Catlin, Administrator of the Estate of Alexander Catlin, deceased, Burlington, Vermont, August 10.

"This machine is intended for boring or drilling stone, by the rotation of a wheel or radial arms, furnished with revolving cutters, which grind or pulverize the stone with which they are placed in contact."

Claim.—"In behalf of the within named Alexander Catlin, I claim the revolving arms or wheel, having a cavity near its centre, to receive the core of the stone, in combination with the revolving cutters, in the manner and for the purpose herein described."

20. For an *Improvement in the Method of Securing Movable Points of Railroad Frogs;* Marshall Curtis and Edgar St. John, Binghampton, New York, August 10.

Claim.—"What we claim as new in our invention is, the combination of the peculiarly formed shank of the frog point and its corresponding channel and socket; said point secured to its seat by spike and bolts, or their equivalents, substantially as described."

21. For an *Improvement in Tanning;* A. K. Eaton, Rochester, New York, August 10.

"My invention consists of a combination, with my tanning liquor, of certain substances which have the effect of facilitating its action; also of preventing the extraction or other matter of the bark or substance from which the tannin is obtained, from acting injuriously upon the leather."

Claim.—"Having thus described my process of tanning leather, what I claim as my invention is, the combination of sulphate of potash with the tanning liquor, substantially in the manner and for the purposes herein set forth."

22. For an *Improvement in Grain and Grass Harvesters;* Daniel Fitzgerald and John H. Smith, City of New York, August 10.

"The nature of this invention is the adaptation of the common grain cradle to machinery. The apparatus consists of a cart, (the two wheels of which are the motors of the machinery,) and the cradling apparatus attached."

Claim.—"What we claim as our invention is, 1st, The construction of the floor in the centre, upon which a man may stand to gather the grain.

"2d, The construction the rim, to which the knives are attached, for the purpose of giving the buts of the grain a bed to stand upon, while being carried through the channel to the centre.

"3d, The constructing a spiral channel within the guards, for the purpose of gathering the grain within the central space."

23. For an *Improvement in Carriages;* Jonathan Fox, Manchester, New Jersey, August 10.

Claim.—"What I claim as my invention is, 1st, Making the hubs of wheels of two disks of wood, with angular scores cut in them, to which the spokes are fitted, so that as the disks are drawn together, they bind the sides as well as the edges of the spokes; said disks of wood being fitted to and confined between two plates of metal, substantially as described.

"2d, The sliding perch, in combination with the levers, ratchet wheel, and pawls, or such analogous devices equivalent to these as will raise the hind end of the body of the carriage and load, when the hind axle stops, while the fore one moves forward; the weight of the hind end of the body and load aiding, as it descends, in propelling the hind axle forward; the body being made to slide upon the rocker of the forward axle as described, or otherwise.

"3d, The sliding perch, in combination with the levers, or such analogous devices equivalent thereto as will raise the load, or a part of it, when the team or moving power starts, so as to partially relieve the team and carriage from the sudden jerk and shock to which it is subject when the connexion is firm and unyielding."

24. For an *Improvement in the Manufacture of Glass Lenses;* John L. Gilliland, City of New York, August 10.

Claim.—"What I claim as my invention is, the manufacture of dioptric lenses of glass in steps or rings, by pressure in metallic moulds, substantially as specified."

25. For an *Improvement in Method of Converting Reciprocating into Rotary Motion;* Charles Howard, Alton, Illinois, August 10.

Claim.—"What I claim as my invention is, an apparatus, substantially such as is herein described, for converting a reciprocating motion into a rotary one, or converting a rotary into a reciprocating motion, consisting of the wheel, levers, and connecting rods, or their equivalents, for the purposes specified."

26. For an *Improvement in Mode of Drying Sized Paper;* John Kingsland, Jr., Saugerties, New York, and Norman White, City of New York, August 10.

Claim.—"Having fully described our invention, what we claim therein as new is, the process of drying sized paper, by passing it between a series of trunks, perforated on two sides, and so arranged, that the hot air passing through these perforations will come in contact with both sides of the paper, and then escape, and not run or be confined with the sheets."

27. For an *Improvement in Reducing Gold Mineral;* William Longmaid, Beaumont Square, England, August 10, 1852; patented in England, January 29, 1852.

Claim.—"I do not claim the use of lime when forming fluxes; but what I claim is, the use of iron, substantially as described, to extract portions of gold, when the same are not readily precipitated by their density."

28. For an *Improvement in Looms for Weaving Pile Fabrics;* Samuel Richardson, Claremont, New Hampshire, August 10.

"These improvements relate chiefly to the peculiar construction and to the mode of operating the pincers, which draw out and insert the wires which are placed between the ground and pile warps, for the purpose of raising the loops which form the pile."

Claim.—"What I claim as my invention is, the spring flaps, or their equivalents, which open and close the pincers upon the wires, and support the wires after they are drawn

from the loops and carried to a proper position, to be inserted between the sheds of warp and guiding them into the same, substantially as described."

29. For an *Improvement in Railroad Car Brakes;* John Schoenherr, Reading, Pennsylvania, August 10.

Claim.—"Having fully described and represented the nature and operation of my improved mode of rendering railroad car brakes inoperative at the pleasure of the engineer, or man in the locomotive tender, and thus dispensing with a corps of brakemen, what I claim therein as new is, the method of arranging and operating the parts which render the brakes inoperative, at the pleasure of the engineer or other hand, viz: hanging the drops, *a*, from arms, *v*, on arbors, *t*, with arms, *s*, projecting in a contrary direction to the arms, *v*, the arms, *s*, being connected by links, *q* and *r*, midway to a lever, *k*, the end, *l*, of which is the fulcrum; the power being applied to the other end, through the eye, *m*, by means of the rope, *n*, which passes through loops, *o*, along the entire train, to the rear end of which it is made fast; the same devices being repeated, and capable of instantaneous action on each car; the arrangement thus having nothing in itself antagonistic to the end in view, the rope, *n*, being always slack, and by its own weight and motion, when the train is under way, keeping the drops, *a*, up and out of the way of the brakes, so that the brakes are always operative, unless the engineer, by winding up the rope, *n*, throws down the drops, *a*, and renders the brakes inoperative for the time being; the whole being substantially as described and represented: by no means intending to claim, however, the interruption of the operation of the brakes, actuated by the crowding of the cars upon the locomotive, by the interposition of drops, when these are interposed by mechanism, the weight and motion of which, when the train is under way, is antagonistic to the counterbalance intended to keep the drops up and out of the way of the brakes."

30. For an *Improvement in Hats;* Benjamin Sherwood, County of New York, August 10.

Claim.—"What I claim as my invention is, 1st, The attaching to a hat a ring, or part or parts of a ring, inside, to fit upon the head, and leave a space around it, for the purpose of producing ventilation, in the manner substantially as described.

"Second, I claim constructing a band, for the purpose of fitting easily to the head, of thin metal, made flexible by cutting out part of the substance, in the manner substantially as above described in the strip, fig. 4."

31. For *Machinery for Threading Wood Screws;* Cullen Whipple, Providence, Rhode Island, August 10.

"My invention and improvement consists of a rotating concave annular burr cutter, for threading screw blanks, and of a combination of the foregoing with suitable rests and turn screws, for presenting the blank to the cutter, and rotating it while being threaded; likewise, of a combination of a vibrating rest to support the screw blank, and a rotating turn screw vibrating with the rest, to turn the blank."

Claim.—"What I claim as my invention is, 1st, An annular concave burr cutter for threading screws, having a helical or conical serrated thread, substantially as described.

"2d, The combination of the moving rests on opposite sides of a revolving screw cutter, with the mechanism herein described, or the equivalent thereof, for operating the same in such manner as to move them simultaneously towards and from the cutter, to press the blanks against the latter to be threaded, and so that the pressure of one blank in one direction may be counteracted by the pressure of another blank in the opposite direction, as set forth.

"3d, The combination of the vibrating rests with the vibrating rotating turn screws, substantially in the manner herein described, so that the blank may be rotated steadily and with regularity, while the rest is carrying it towards the cutter, to sink a screw thread on it."

32. For an *Improvement in Mill Dress;* John W. Kane, New Carlisle, Ohio, August 10.

Claim.—"I do not claim a circular mill-stone dress, in which the furrows are arcs of circles swept from a single centre; but what I do claim is, the particular mill dress represented in fig. 1, and laid down by the pattern shown in fig. 2, constructed and arranged as described, or in any manner substantially the same."

33. For an *Improvement in Ventilators;* Mortimer M. Camp, New Haven, Connecticut, August 17.

Claim.—"I do not claim the upper cylinder, the flanches attached thereto, the lower

22. For an *Improvement in Grain and Grass Harvesters;* Daniel Fitzgerald and John H. Smith, City of New York, August 10.

"The nature of this invention is the adaptation of the common grain cradle to machinery. The apparatus consists of a cart, (the two wheels of which are the motors of the machinery,) and the cradling apparatus attached."

Claim.—"What we claim as our invention is, 1st, The construction of the floor in the centre, upon which a man may stand to gather the grain.

"2d, The construction the rim, to which the knives are attached, for the purpose of giving the buts of the grain a bed to stand upon, while being carried through the channel to the centre.

"3d, The constructing a spiral channel within the guards, for the purpose of gathering the grain within the central space."

23. For an *Improvement in Carriages;* Jonathan Fox, Manchester, New Jersey, August 10.

Claim.—"What I claim as my invention is, 1st, Making the hubs of wheels of two disks of wood, with angular scores cut in them, to which the spokes are fitted, so that as the disks are drawn together, they bind the sides as well as the edges of the spokes; said disks of wood being fitted to and confined between two plates of metal, substantially as described.

"2d, The sliding perch, in combination with the levers, ratchet wheel, and pawls, or such analogous devices equivalent to these as will raise the hind end of the body of the carriage and load, when the hind axle stops, while the fore one moves forward; the weight of the hind end of the body and load aiding, as it descends, in propelling the hind axle forward; the body being made to slide upon the rocker of the forward axle as described, or otherwise.

"3d, The sliding perch, in combination with the levers, or such analogous devices equivalent thereto as will raise the load, or a part of it, when the team or moving power starts, so as to partially relieve the team and carriage from the sudden jerk and shock to which it is subject when the connexion is firm and unyielding."

24. For an *Improvement in the Manufacture of Glass Lenses;* John L. Gilliland, City of New York, August 10.

Claim.—"What I claim as my invention is, the manufacture of dioptric lenses of glass in steps or rings, by pressure in metallic moulds, substantially as specified."

25. For an *Improvement in Method of Converting Reciprocating into Rotary Motion;* Charles Howard, Alton, Illinois, August 10.

Claim.—"What I claim as my invention is, an apparatus, substantially such as is herein described, for converting a reciprocating motion into a rotary one, or converting a rotary into a reciprocating motion, consisting of the wheel, levers, and connecting rods, or their equivalents, for the purposes specified."

26. For an *Improvement in Mode of Drying Sized Paper;* John Kingsland, Jr., Saugerties, New York, and Norman White, City of New York, August 10.

Claim.—"Having fully described our invention, what we claim therein as new is, the process of drying sized paper, by passing it between a series of trunks, perforated on two sides, and so arranged, that the hot air passing through these perforations will come in contact with both sides of the paper, and then escape, and not run or be confined with the sheets."

27. For an *Improvement in Reducing Gold Mineral;* William Longmaid, Beaumont Square, England, August 10, 1852; patented in England, January 29, 1852.

Claim.—"I do not claim the use of lime when forming fluxes; but what I claim is, the use of iron, substantially as described, to extract portions of gold, when the same are not readily precipitated by their density."

28. For an *Improvement in Looms for Weaving Pile Fabrics;* Samuel Richardson, Claremont, New Hampshire, August 10.

"These improvements relate chiefly to the peculiar construction and to the mode of operating the pincers, which draw out and insert the wires which are placed between the ground and pile warps, for the purpose of raising the loops which form the pile."

Claim.—"What I claim as my invention is, the spring flaps, or their equivalents, which open and close the pincers upon the wires, and support the wires after they are drawn

from the loops and carried to a proper position, to be inserted between the sheds of warp and guiding them into the same, substantially as described."

29. For an *Improvement in Railroad Car Brakes;* John Schoenherr, Reading, Pennsylvania, August 10.

Claim.—"Having fully described and represented the nature and operation of my improved mode of rendering railroad car brakes inoperative at the pleasure of the engineer, or man in the locomotive tender, and thus dispensing with a corps of brakemen, what I claim therein as new is, the method of arranging and operating the parts which render the brakes inoperative, at the pleasure of the engineer or other hand, viz: hanging the drops, *a*, from arms, *v*, on arbors, *t*, with arms, *s*, projecting in a contrary direction to the arms, *v*, the arms, *s*, being connected by links, *q* and *r*, midway to a lever, *k*, the end, *l*, of which is the fulcrum; the power being applied to the other end, through the eye, *m*, by means of the rope, *n*, which passes through loops, *o*, along the entire train, to the rear end of which it is made fast; the same devices being repeated, and capable of instantaneous action on each car; the arrangement thus having nothing in itself antagonistic to the end in view, the rope, *n*, being always slack, and by its own weight and motion, when the train is under way, keeping the drops, *a*, up and out of the way of the brakes, so that the brakes are always operative, unless the engineer, by winding up the rope, *n*, throws down the drops, *a*, and renders the brakes inoperative for the time being; the whole being substantially as described and represented: by no means intending to claim, however, the interruption of the operation of the brakes, actuated by the crowding of the cars upon the locomotive, by the interposition of drops, when these are interposed by mechanism, the weight and motion of which, when the train is under way, is antagonistic to the counterbalance intended to keep the drops up and out of the way of the brakes."

30. For an *Improvement in Hats;* Benjamin Sherwood, County of New York, August 10.

Claim.—"What I claim as my invention is, 1st, The attaching to a hat a ring, or part or parts of a ring, inside, to fit upon the head, and leave a space around it, for the purpose of producing ventilation, in the manner substantially as described.

"Second, I claim constructing a band, for the purpose of fitting easily to the head, of thin metal, made flexible by cutting out part of the substance, in the manner substantially as above described in the strip, fig. 4."

31. For *Machinery for Threading Wood Screws;* Cullen Whipple, Providence, Rhode Island, August 10.

"My invention and improvement consists of a rotating concave annular burr cutter, for threading screw blanks, and of a combination of the foregoing with suitable rests and turn screws, for presenting the blank to the cutter, and rotating it while being threaded; likewise, of a combination of a vibrating rest to support the screw blank, and a rotating turn screw vibrating with the rest, to turn the blank."

Claim.—"What I claim as my invention is, 1st, An annular concave burr cutter for threading screws, having a helical or conical serrated thread, substantially as described.

"2d, The combination of the moving rests on opposite sides of a revolving screw cutter, with the mechanism herein described, or the equivalent thereof, for operating the same in such manner as to move them simultaneously towards and from the cutter, to press the blanks against the latter to be threaded, and so that the pressure of one blank in one direction may be counteracted by the pressure of another blank in the opposite direction, as set forth.

"3d, The combination of the vibrating rests with the vibrating rotating turn screws, substantially in the manner herein described, so that the blank may be rotated steadily and with regularity, while the rest is carrying it towards the cutter, to sink a screw thread on it."

32. For an *Improvement in Mill Dress;* John W. Kane, New Carlisle, Ohio, August 10.

Claim.—"I do not claim a circular mill-stone dress, in which the furrows are arcs of circles swept from a single centre; but what I do claim is, the particular mill dress represented in fig. 1, and laid down by the pattern shown in fig. 2, constructed and arranged as described, or in any manner substantially the same."

33. For an *Improvement in Ventilators;* Mortimer M. Camp, New Haven, Connecticut, August 17.

Claim.—"I do not claim the upper cylinder, the flanches attached thereto, the lower

cylinder, nor either set of the wings upon a vertical shaft therein; but what I do claim as new is, the two cones arranged and combined with a ventilator, composed of revolving vanes and flanches and cylinders, operating as above described and set forth."

31. For *Improvements in File Cutting Machinery;* John W. Conklin, Henry L. Sidman, and Eugene Wintner, Ramapo, New York, August 17.

Claim.—"Having described our improvements in machinery for cutting files, what we claim as our invention is, as herein constructed and combined, the racks, pinions, cams, or eccentrics, rods, and springs, in connexion with the vibrating hammer, as described, for the graduation of the blow, at the commencement of the operation."

35. For a *Machine for Making Wrought Iron Railroad Chairs;* Robert Griffiths, Newport, Kentucky, August 17.

"The nature of my invention consists, 1st, in a combination of devices, whereby my machine is rendered capable of adjustment, for cutting and turning the clips of a wrought iron railroad chair, of varied forms and of any required size, to fit the various sizes and patterns of rails in use.

"2d, In so forming and operating the cutting edges, that they shall shear the plate in such lines, that when cut, it shall be perfectly free from the dies, and not remain in contact with them, to draw the temper, and render them incapable of making a smooth cut, as is the case with other machines heretofore used for this purpose."

Claim.—"Having thus described my invention, what I claim therein as new is, 1st, the arrangement and combination of the feathered wedge and dies, as described, for filling the cavity between and fitting around the knuckle end of the shears and benders, forming an adjustable, solid, and level bed for the centre of the plate, whilst being cut and bent, and preventing the fulcra of the shears and benders from moving towards the centre, away from the set screws.

"Secondly, I claim furnishing the caps of the pedestals with adjustable cutters, the cutting edges of which are nearer to each other at the outer than at the inner end, and which shear the plate, in conjunction with the cutters on the face of the shears, which are narrower at their outer than their inner end, in order to cut the clip of the chair narrowest at the point, and thereby leave it perfectly free and clear of the cutters in the cap, so that the cap will lift free from the plate."

36. For *Improvements in Spark Arresters;* Joseph Leeds, George H. Oat, Jr., and Alfred A. Oat, Assignors to Joseph Leeds, Philadelphia, Pennsylvania, August 17.

"The nature of our invention consists in surrounding the spark chamber, or that part which usually constitutes the outside of the stack, with a draft flue, which has openings below, flared or otherwise, to take in the air, and which extends up above the top of the inner chimney, and may be covered by a cap, or otherwise; said draft flue being for the purpose of aiding the draft of the chimney, which becomes impeded by the separation of the sparks from the other products of combustion."

Claim.—"Having thus fully described our invention, what we claim therein as new is, combining with a stack or chimney, provided with chambers and openings for separating and passing out the smoke and gases, and retaining the sparks, substantially such as herein described, the draft flue around the stack which takes in air at the bottom, and furnishes at the top of the chimney additional draft to supply that impeded by the separation of the sparks; the whole being arranged substantially as herein set forth."

37. For an *Improvement in Cotton Presses;* Lewis Lewis, Vicksburg, Mississippi, August 17.

Claim.—"Having fully described the nature and operation of my press, what I claim therein as of my invention is, the arrangement of the press herein above described, in such manner that it may be conveniently charged in an upper story of the building in which it is placed, and actuated and discharged in a lower story of the same, substantially as herein set forth, reference being had in my claims for Letters Patent, to the drawings and specifications as filed and herein before set forth."

38. For an *Improvement in Hernia Truss;* Allen I. Lownsberry, Sommerville, Tennessee, August 17.

"The principal feature of this invention, and upon which its utility and excellence mainly depend, consists in the peculiar form of the front plate, or pubic brace, and its combination, as a strong support to the bowels and abdomen, with the curative action of

the balls upon the track of the inguinal canal, and its peculiar connexion with the other parts of the apparatus."

Claim.—"What I claim as my invention is, the peculiar shape of the two balls, and their arrangement upon the slides, so that they may be moved upward and downward, and right and left, to any part of the metallic plate on the pubic brace, and thus be fitted to any rupture in the abdominal rings, or on any sized person, and their combination with the pubic brace, as above described."

39. For an *Improvement in Artificial Legs;* B. Frank. Palmer, Philadelphia, Pennsylvania, August 17.

Claim.—"I am aware that the tendo achilles has been extended upward and attached to the thigh piece, for the purpose of drawing upward the heel, and depressing the forward part of the foot, when the leg is straightened; and therefore I do not claim that arrangement as my invention. But what I do claim as new is, attaching the upper end of the tendo achilles to a lever, or to its equivalent mover, which is united to an auxiliary tendon, that descends from its connexion with the thigh piece; and also the so arranging of the said lever and tendons that when the weight of the person is thrown upon the ball of the foot, in walking, the powerful downward strain, which will thereby be exerted upon the tendo achilles, will exert little or no influence upon the said auxiliary tendon, (which descends from the thigh piece,) or at any rate, no influence that will have an appreciable tendency to bend the knee, or give instability thereto, substantially as herein set forth."

"I also claim the vibrating brace and elastic cord, operating in combination, substantially in the manner and for the purposes herein set forth."

40. For an *Improvement in the Neck Yoke of Horses;* Calvin L. Rawdon, Bristol, Ohio, August 17.

Claim.—"What I claim as my improvement is, the spiral springs, operated by the rods giving extension and contraction to the yoke, in the manner and for the purpose herein set forth."

41. For an *Improvement in Artificial Legs;* Jonathan Russell, Philadelphia, Pennsylvania, August 17.

"The nature of my invention is so combining and arranging the several parts of an artificial leg, as that the knee joint shall be firmly locked by the weight upon it, when applied to either the toe or heel part of the foot, thus making the knee joint perfectly rigid, when the leg is erect, and the weight of the body or a portion of it is thrown upon it, at the will of the wearer."

Claim.—"Having thus fully described my invention, what I claim therein as new is, so operating the lever through the spring, by means of the cords, which are respectively attached to and operated by the toe and heel part of the foot, as that when the leg is bent forward or back on the ankle joint, the knee joint shall be locked by said lever, substantially as described."

42. For an *Improvement in Bedstead Fastenings;* William Shaw, Clarion, Pennsylvania, August 17.

Claim.—"What I claim as my invention is, the plug as above described, in combination with the clamp or clamps, for fastening bedsteads."

43. For an *Improvement in Hot Air Furnaces;* George S. G. Spence, Boston, Massachusetts, August 17.

Claim.—"Now I do not claim a descending draft as such, or an alternately descending and ascending draft; nor do I claim a draft divided and carried in different directions through several pipes or columns at a time; nor do I claim one undivided draft, carried through several pipes and columns at a time: but what I do claim as my invention is, the combination and arrangement of the ash or soot separate chambers and the flues, from whose external surfaces the heat is radiated into the air chamber of the hot air furnace; that is to say, I claim the combination and arrangement of the descending flue at and down the back of the fire place, the ash flue chamber, the ascending and descending arched pipe, the ash flue chamber, the ascending and descending arched pipe, the ash flue chamber, and the vertical flue discharge pipe, carried up against the back of the fire place, and having a communication with the fire place and a damper; all substantially as specified."

44. For an *Improvement in Machinery for Forming Hat Bodies;* Thomas Walker, City of New York, August 17.

Claim.—"Having described the construction and operation of the parts, I wish it to be

distinctly understood that the apparatus for picking and separating the fur forms no part of my invention, neither does the movable trunk, all these parts being well known and in ordinary use in cotton pickers and gins; neither do I claim retaining the fibre on the former by exhaustion by a blower, that being public property, having been shown in a patent issued to T. R. Williams, in England, in 1833; neither do I claim the use of water, to form the packing for the cylinder, that having been used in other machinery, and hot and cold water have been used in felting cloth and hat bodies; therefore, this forms no part of my claims.

"I do not limit myself to the screw, to raise and lower the former and trunk, as a rack and pinion or similar means may be used. But what I claim is, 1st, The combination of the water packed cylinder, former, and sliding and revolving shaft, for the purposes and as described.

2d, I claim giving alternate motion to the former and blower case, so that one is raised while the other is lowered, in the manner and for the purposes described.

"3d, I claim the hood, with its lining, by which steam or other gaseous pressure is made to force the bag or lining, on to the bat or former, in combination with the standing perforated pipe, or its equivalent, by which the bat is wetted through the perforations in the former, as described and shown."

45. For an *Improvement in Coloriferes;* Samuel Whitmarsh, Northampton, Massachusetts, August 17.

Claim.—"What I claim as my invention is, the combination of the water supply reservoir, the chamber or bed of sand, and a furnace or chamber of combustion; the whole being made to operate substantially as specified."

46. For an *Improvement in the Curriers' Beam and Knife;* James D. Willoughby, Carlisle, Pennsylvania, August 17.

Claim.—"What I claim as my invention is, the construction of a curriers' beam, with flaps on its edges furnished with springs and gauges, or their equivalents, for the purpose of dispensing with the kneeing, and prevention of cutting through, and production of regular thickness of leather.

"I also claim the construction of a knife, made adjustable by the eccentric handle or its equivalent, in connexion with the gauges or guides, substantially as and for the purpose set forth in the foregoing specification and accompanying drawings."

47. For an *Improvement in Processes for Making Paints;* Washington F. Davis, Assignor to Birdsill Cornell, City of New York, August 17.

Claim.—"I am aware that various mixtures of gelatine, albumen, gums, and gum resins have been used in watery solutions, for making a cheap paint that cover extensive surfaces; but such paints as the gums dry, crack, and leave fissures in the surfaces so covered, and have other defects; I do not, therefore, claim of use of watery solutions with such materials: but what I claim as my invention is, the use of a watery solution of the sulphate of zinc, to be mixed with white lead, zinc white, or other oil paints, in the manner herein set forth."

48. For an *Improved Fastener of Bits to Braces;* Erasmus Smith, Assignor to David Maydole, Norwich, New York, August 17.

Claim.—"Having described my improved hand drill or brace, what I claim as new therein is, the combination of the cam lever with the lever spring-catch, for securing the bit in the socket, and releasing it therefrom; the same being constructed, arranged, and operating substantially as described."

49. For an *Improvement in Manufacturing Cord Buttons;* Nelson Perkins, Wawarsing, New York, Assignor to Samuel Dow, Westfield, Massachusetts, August 17.

Claim.—"What I claim as my invention is, the preparation of the cords, in the process of manufacturing cord buttons, by gluing them together, substantially in the manner and for the purpose herein set forth."

50. For an *Improvement in Bill Registers;* J. N. Ayres, Stamford, Connecticut, August 24.

"The principal object of this invention is to show at a glance, to those persons in a counting house or other place of business, whose duty or wish it is to know, what bills are becoming payable or receivable every month, and their dates and amounts."

Claim.—"Having thus described my invention, I will now proceed to state what I claim:

"In combination with the perpetual calender in the same table, frame, or box, I claim the bill register, consisting of the strips or sheets of paper, or other material, suitably ruled for names and amounts, and inserted in or attached to the table, frame, or box, in any convenient way, so as to be easily removable or renewable, on either side of the columns of days of the month and week, under suitable headings, which denote whether the bills are payable or receivable, as herein substantially set forth."

51. For an *Improvement in Cooking Stoves;* Reuben J. Blanchard, Albany, New York, August 24.

"My improvement consists in introducing into the front and back flues, a separator, to divide the columns of heated gases, during a portion of their descent and ascent in these flues."

Claim.—"What I claim as my invention is, the placing the separators in the front and back descending and ascending flues of a cooking stove, to divide the products of combustion, while they are permitted to pass undivided over the top and under the bottom plates of the oven, substantially as described in the above specification."

52. For an *Improvement in Instruments for Lasting Boots;* Hezekiah Conant, Worcester, Massachusetts, August 24.

Claim.—"What I claim as of my invention is, the combination of the two levers, connected together and connected to the jaws, also connected to the step, by which combination, on opening the pincers, the simultaneous motion of the two jaws are guided, so as to take hold of both sides of the leather, and by pressing the handles towards each other, bring up the leather with equal tension on both sides. I claim this for the purpose and in form, substantially as above described."

53. For an *Improved Machine for Cutting Cheese;* Walter K. Foster, Bangor, Maine, August 24.

Claim.—"I do not claim the mere combination of a disk and spindle; but what I do claim as my invention is, the combination of the groove and the slot with the spindle and its sustaining board, so as to guide the point of the knife, and support the pointed end of the knife, when the knife is forced down through the cheese, as stated.

"And in combination with the groove, slot, and plate or board, I claim the secondary rotary board, to be applied and used substantially in manner and for the purpose as specified."

54. For an *Improvement in a Bed for Invalids;* Stevens D. Hopkins, Staunton, Virginia, August 24.

"The nature of my invention consists in arranging a frame, upon or within which any ordinary bedstead may stand, with a sheet, hammock, or mattress suspended from a carriage on top of said frame, so that it may be raised up or rest upon the bed, as the case may be, or removed from over the bed and used as a swing, for gently exercising or for removing the patient from one bed to another, without lifting, as is usually done."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, suspending the sheet, hammock, or mattress, upon which the patient lies, to a carriage, which moves on a frame placed over or around a common bed, so that by said carriage the patient may be raised up or let down upon the bed, or moved from one place to another, or gently exercised; the whole being arranged, combined, and operating substantially in the manner described and fully shown."

55. For an *Improvement in Instruments for Lasting Boots;* Benjamin Livermore, Hartland, Vermont, August 24.

Claim.—"I do not claim as my invention the screw, the standard, the nut, or the arms; but what I do claim as my invention is, the mode of bringing the arms together, by the means of the slots in the arms, and the bolt operating in the slots, when this is used in combination with the standard, substantially in the manner herein described."

56. For an *Improvement in Signal Telegraphs;* Charles Latimer, Washington, District of Columbia, August 24.

"The nature of my invention consists in the arrangement of colored and white lights, one above the other, into cornets and numbers."

Claim.—"What I claim as my invention is, the formation of a complete system of telegraphic signals, by means of a vertical arrangement of white and colored lights, or their equivalents, by which any number and species of signals may be made with ease and simplicity."

57. For an *Improvement in Churns;* Rufus Maxwell, Lewis County, Virginia, August 24.

Claim.—"I claim, 1st, the forcing of the milk through a rack, by revolving the churn in an orbit, without turning it on its axis.

"2d, The bow and rods connected together, as above described."

58. For an *Improved Abutment Motion for Reversible Rotary Engines;* Cassius A. Mills, Coldwater, Michigan, August 24.

Claim.—"What I claim as my invention is, the combination, for the purpose of withdrawing the sliding heads at proper intervals and returning them, whichever way the engine is working, of the rods, the levers, the wheels, with their wedge-shaped projections or inclines, and the springs; the whole arranged and operating in any way substantially as set forth."

59. For an *Improvement in Machines for Cutting Hand Rails;* George B. Pullinger, Philadelphia, Pennsylvania, August 24.

Claim.—"What I claim as my invention is, arranging the rollers, one above the other, within a revolving frame, so as to allow the curved roller, or its equivalent, being substituted for the roller at the time desired, and in the manner and for the purpose herein fully specified."

60. For an *Improvement in Horse Power;* David Russell, St. Louis, Missouri, August 24.

"My improvement consists of a novel method of employing the power of horses, by which their weight as well as draft is rendered available, and by which the velocity of the running parts is not reduced, by extending the circle or sweep upon which the friction wheel travels."

Claim.—"Having thus fully described my improved horse power, what I claim therein as new is, 1st, the combination of the canting tread wheel, the horizontal sweep shaft, and friction wheel, for producing motion, in the manner described, by which the wheel is always running down hill, by throwing the weight of the horse on to the canting wheels, just forward of it, as above described."

61. For *Improvements in Mechanism for Griping Wood Screw Blanks, &c.;* Thomas J. Sloan, City of New York, August 24.

Claim.—"What I claim as my invention for operating the griping jaws on the mandrels of machines for threading or shaving the heads of wood screws, is, the employment of a wedge on a stem within the mandrel, to act on the jaws, to close them, substantially as specified, when the said wedge stem is combined with a sliding frame, or its equivalent, by means of an interposed spring, substantially as specified, for the purpose of adapting the jaws to the griping of blanks of various sizes, as set forth.

"And I also claim, in combination with the said spring connexion, for the purpose specified, the making of the wedge faces curved, substantially as specified, to insure an equal or nearly equal force on the griping jaws, as set forth."

62. For an *Improvement in Threading Pointed Wood Screws;* Thomas J. Sloan, City of New York, August 24.

Claim.—"What I claim as my invention is, giving to the mould or former, or its equivalent, motion, substantially as specified, whereby the cutting away of the metal at the end of the shank is divided amongst several threading motions, instead of being cut away at the first threading motion, as heretofore practised."

63. For an *Improvement in Railroad Truck;* Edwin Stanley, Bennington, New York, August 24.

Claim.—"I claim as my invention, 1st, the combination of the brake with the wheel and rail, arranged and operating substantially as described.

"2d, Making the wheel substantially as herein described, for the purposes of preventing from clogging with snow, or other substances, and giving it a better hold upon the rail, as above suggested."

64. For an *Improvement in Apparatus for Feeding Boilers;* Andrew Walker, Jr. Johnsbury, Vermont, August 24.

Claim.—"What I claim as my invention is, the combination of the heater or vessel and its pipes and stop cocks, or either of them, with the tank, boiler, and force pump, so as to operate therewith, or enable the force pump to be operated, substantially in manner and under the circumstances as above set forth."

65. For an *Improvement in Mills for Mashing Vegetables and Mixing Clay;* Clark Alvord, Geddes, New York, August 31.

Claim.—"What I claim as my invention is, the use of grated hollow cylinders, operating together, so that the grates of one cylinder must be between the grates of another cylinder of like construction, thereby forcing the material operated upon from the periphery of the cylinder or cylinders to the inside of such cylinder or cylinders, thereby mashing, grinding, and mixing the same, as above set forth."

66. For an *Improved Reverberatory Furnace;* Christopher G. Best, Albany, New York, August 31.

Claim.—"I claim the reverberatory furnace, constructed as described; the fuel with the fire box being above the metals to be melted in the chamber, and bringing the flame and heated products of combustion vertically down through the metals in the chamber, in the manner and for the purposes set forth."

67. For an *Improvement in Wash Boards;* Lester Butler, Kenoshu, Wisconsin, August 31.

Claim.—"What I claim is, the curved or circular form of the crimp, giving a better chance for the suds and water to remain amid the clothes during the process of rubbing, and also keeping the water near the centre of said board; thus rendering the work easier than the old fashioned form."

68. For a *Roller Saw-Set;* Abel Bradway and Elijah Valentine, Monson, Massachusetts, August 31.

Claim.—"Having fully described our improved saw-set, what we claim therein as new is, the stamps alternating with the spaces upon the end of a cylinder, in combination with a beveled cylinder, which is caused to revolve with equal velocity in the direction opposite to that of the cylinder, arranged in the manner and for the purpose substantially as herein described."

69. For an *Improvement in Kilns for Pottery;* George R. Booth, Hanley, England, August 31; patented in England, June 15, 1843.

Claim.—"What I claim as my invention is, the arrangement of the fire hearth below the oven bottom, and provided with suitable apertures for the admission of air, to regulate the combustion, substantially as described, when this is combined with the oven or heating chamber, provided with a tube, or the equivalent thereof, as specified, for discharging the heat above the bottom of the oven, and diffusing it in the oven, and also provided with outlet flues or apertures at or near the bottom, and with apertures or tubes at or near the top of the discharge of gases or steam, all substantially as herein described and for the purpose specified."

70. For an *Improved Blind Operator and Fastener;* James R. Creighton, Cincinnati, Ohio, August 31.

"My improvements consist in a method of opening, closing, and fastening window blinds from the inside, by machinery which passes from the inside, under the stool and through the subsill; the motion of the blind being accomplished by a straight shove out or pull in, as the case may be, such a motion only requiring a straight mortise through the subsill."

Claim.—"Having thus described the nature of my improvement in blind operators, what I claim therein as new is, the combination and arrangement of the sliding plate, provided with a notch and extension rod and handle, with the vibrating link and fastening, and with the catch and notches, by which I am enabled to operate a blind from the inside, by a straight shove or pull, as the case may be, and to fasten it shut or partially open, as required."

71. For an *Improvement in Artificial Legs;* John S. Drake, City of New York, August 31.

Claim.—"I do not claim the use of a spring to throw the lower part of the leg forward, but I am not aware of any straight or curved spring having been used with a skeleton knee, as herein shown. I do not claim the open skeleton, to receive the stump, as the ordinary wooden legs have been secured by straps and bands, acting in the same manner and for the same purpose.

"What I claim is, 1st, the skeleton knee piece, in combination with the spring, attached at its ends to the upper and lower parts of the leg, as described and shown.

"2d, I claim the arrangement of the spring toes on their centre, kept down by the spring, as described and shown.

"3d, I claim the locking piece and hook, to allow of the bending of the leg, as described and shown."

72. For an *Improvement in Oil Cans;* Samuel Field and Charles W. Heald, Barre, Massachusetts, August 31.

Claim.—"What we claim as our invention is, the combination of the receiving chamber, D′, with the chamber, D, and flanch, L; the whole being constructed, and arranged, and operating in manner and for the purpose substantially as herein set forth and specified."

73. For *Improvements in Printing Press;* George P. Gordon, City of New York, August 31.

Claim.—"Having fully described and explained my improvements, I do not claim the periphery of a cylinder as a distributing surface for the ink, nor the segment of the cylinder, to form a place for the form of type, so arranged by catches and stops that it may be turned over any distance, to receive the form, as in the Voorhies press; but what I do claim is, the arrangement and application of a cylinder which always remains stationary in its own position, as well while receiving the form as when used as a distributing surface.

"I do not claim an arm or single frame, to carry one set of rollers around the periphery of a cylinder, as in the Voorhies press; but I do claim the combination and arrangement of several sets of rollers in one frame, to traverse round the periphery of a cylinder, when these sets of rollers alternately or consecutively pass over the form, and admit an impression to be taken, between the time one of the sets leaves the form and the next set arrives to it, for the purpose of giving slow motions to the inking, with rapid impressions upon the same form; thus effecting more speed, as regards the amount or number of impressions to be produced in a given time.

"I do not claim the continuous sheet, nor feeding a continuous sheet of paper to a printing press; but I do claim the arrangement of the gauge, 1, guides, 2, pawl, *r*, cranks, *s* and *d*′, rod, E′, pin, *f*, and wheels, *a*′, in combination with the shears for cutting off the sheet after it is printed, and the cam, *y*, from which it receives its motion; the whole of these parts operating as described; all of which is herein fully described and set forth."

74. For an *Improvement in Washing Machines;* Jarvis T. Mudge, Washington, District of Columbia, August 31.

Claim.—"Having described my improvement, what I claim as my invention is, the providing a washing machine with a hinged flap rubbing board, or its equivalent, for turning the clothes in the tub, in combination with the dasher and hinged presser, for the purposes set forth and shown in the specification and accompanying drawings."

75. For an *Improvement in Governor for Steam Engines;* George S. Stearns and Wm. Hodgson, Cincinnati, Ohio, August 31.

Claim.—"What we claim as new is, the combination of the quadrants and the cylindrical rack, arranged and operating substantially as set forth; not confining ourselves to the cylindrical form of the rack; other forms may be used, if found to suit, such as square, or any polygon form."

76. For a *Process for Restoring Shape and Tempering Articles of Hardened Steel;* John Silvester, West Bromwich, England, August 31; patented in England, July 17, 1850.

Claim.—"And having now described my said invention, and the manner in which the same is to be performed, I declare that what I claim is, the curing or remedying the distortion which has taken place in steel plates during the operation of hardening, by com-

pressing them between dies, previously heated to a sufficient degree to "bring back" or "let down" the temper; the mechanical pressure to be applied while the plates are in the course of being tempered, (the pressure being continued during the process of tempering,) as before exemplified and described."

77. For an *Improvement in Brick Machines;* Arad Woodworth, 3d, and Samuel Mower, Boston, Massachusetts, August 31; patented in England, January 24, 1852.

Claim.—"Having described our improvements, what we claim as of our invention is combining with the percussion machinery, the lower piston or pistons and machinery, to produce a compression of the bottom surface of the brick, and machinery to produce a compression of the top surface of the brick; the whole being substantially as herein before described; not meaning such compression of the same as is produced by the percussion of the ram, but a separate compression, effected by other means, as described.

"We also claim the improvement of constructing each of the orifices of the mould charger with flaring or inclined sides, inclining inwards towards each other as they descend; the whole being substantially in manner, and to effect the object or overcome the difficulty, herein before stated.

"We also claim the improvement of combining with the adjustable gate, or striker, a mechanism that will cause it to rise upwards as the mould charger moves forwards towards the moulds; such rising upwards of the striker being for the purpose herein before explained."

78. For an *Improved Metallic Stuffing-Box Packing in Steam Engines;* Ebenezer Winship, City of New York, August 31.

Claim.—"Having fully described my invention, what I claim therein as new is, the combination of an elastic ring, made to fit tightly on the rod and loosely in the stuffing box, and having an intercepting tongue and spring plate, to prevent the steam from escaping through the slot therein, with the plate, or its equivalent, fitting tightly over the ring, and loosely encircling the rod, and the gasket, or its equivalent, above said plate, substantially as described."

79. For an *Improvement in Electro-Magnetic Fire Alarms;* Henry Van Ansdall, Preble County, Ohio, August 31.

Claim.—"I claim the combination and arrangement of a signal wheel with two elastic circuits, so that when one is broken the wheel may revolve, and operate a key in the other circuit.

"2d, I also claim the mode of constructing an elastic circuit, by breaking, tapping, and binding with a combustible material, or equivalent, for the purpose of making it sensitive to fire, as herein described."

Re-issues for August, 1852.

1. For an *Improvement in the Manufacture of Bullets, &c.;* George W. Campbell, City of New York, dated November 20, 1847; re-issued August 3, 1852.

Claim.—"I do not therefore claim as of my invention, casting bullets, buckles, and other articles, in a series of moulds moving under a spout, when the surface on which the lead is poured is unbroken; nor do I wish to limit myself to the precise construction of moulds, nor to the special arrangement of them, so long as the same results are produced by equivalent means. But what I claim as my invention in the method of casting bullets, &c., in a succession of connected moulds, is, jointing them together, so that they shall separate and come together in vertical planes, at right angles to the line of motion of the series, or nearly so, substantially as and for the purpose specified."

2. For an *Improvement in Making Lamp Black;* John G. Muir, Philadelphia, Pennsylvania, dated November 13, 1844; re-issued August 24, 1852.

Claim.—"What I claim as my invention and improvement is, the mode herein described of burning lamp black, that is to say, burning it in a confined building or room, without chimney or draft, substantially in the manner set forth in the above specification."

Designs for August, 1852.

1. For a *Design for a Cooking Stove;* Samuel Eberly, Mechanicsburg, Pennsylvania, August 3.

Claim.—"What I claim as new is, the combination of the ornaments with the panels raised on the surface of the side plate of the stove."

2. For a *Design for a Water Cooler;* Patrick Molony, Cincinnati, Ohio, August 3.

Claim.—"What I claim as my production is, the design and configuration of an ornamental water cooler, substantially as described and represented in the annexed drawings."

3. For a *Design for a Cooking Stove;* Russell Wheeler and Stephen A. Bailey, Utica, New York, August 3.

Claim.—"We do not claim the exclusive right to the general construction of the stove; but what we do claim is, the design and configuration of the ornaments and mouldings, as described and set forth in the accompanying drawings."

4. For a *Design for a Cooking Stove;* Garretson Smith, Henry Brown, and Julius Holzer, Assignors to North, Harrison, and Chase, Philadelphia, Pennsylvania, August 3.

Claim.—"What we claim as our invention is, the design and configuration of the mouldings, conical rods, petals, rosette, scroll, and foot, as herein described."

5. For a *Design for a Grate Frame and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

6. For a *Design for a Grate Frame and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

7. For a *Design for a Grate Frame, Summer Piece, and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

8. For a *Design for a Cooking Stove;* Frederick Schultz, Assignor to William P. Cresson, District of Northern Liberties, Pennsylvania, August 10.

Claim.—"What I claim as my invention is, the ornamental designs for a flat top cooking stove, as herein described and arranged, and represented in the annexed drawings."

9. For a *Design for a Stove;* Jacob Beesley and Edward Delany, Assignors to William P. Cresson, Philadelphia, Pennsylvania, August 10.

Claim.—"What we claim as our invention is, the ornamental designs for a nine-plate stove, as herein described and represented in the annexed drawings."

10. For a *Design for a Cooking Stove;* Jacob Beesley, Assignor to Richard Peterson, Philadelphia, Pennsylvania, August 10.

Claim.—"What I claim as my invention is, the ornamental designs for a stove, called the Complete Cook, as herein described, and represented in the annexed drawings."

11. For a *Design for a Parlor Stove;* Dutee Arnold, Providence, Rhode Island, August 17.

Claim.—"What I claim as my production is, the new design, consisting of the bead and lattice work, and human figures, herein above described and represented in the drawings."

12. For a *Design for a Six Plate Stove;* Samuel F. Pratt, Boston, Massachusetts, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a six plate stove."

13. For a *Design for a Cooking Stove;* John S. Perry, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

14. For a *Design for a Cooking Stove;* John S. Perry, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of orna-

mental figures and forms, represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

15. For a *Design for a Parlor Stove;* Ezra Ripley, Assignor to Nicholas S. Vedder, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove plates, the same as herein described and represented in the annexed drawing."

16. For a *Design for a Parlor Stove Plate;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove plate, the same as herein described and represented in the annexed drawings."

17. For a *Design for the Top and Front Plates of a Parlor Stove;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of parlor stove top and front plates, the same as herein described, and represented in the annexed drawings."

18. For a *Design for Parlor Stove Front;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove front, the same as herein described, and represented in the annexed drawings."

SEPTEMBER.

1. For an *Improvement in Smoothing Irons;* Fedral C. Adams, Aberdeen, Ohio, September 7.

Claim.—"What I claim as my improvement is, 1st, the basket grate, formed by the bars, as mentioned in the specification.

"2d, I claim the concave form in the top of the smoothing portion of the iron, all for the purposes set forth."

2. For an *Improvement in Machines for Making Carriage Wheels;* Chauncey H. Guard, Brownville, New York, September 7.

Claim.—"What I claim as my invention is, the manner of feeding up the boring spindle slowly, and bringing it back speedily, whilst the driving spindle is turned constantly in one direction, and with the same velocity, viz: by connecting the driving spindle to the boring spindle, by means of the collared bar, and by a cog-wheel on the former, gearing into a pinion on the latter, and by screw threads formed upon the said spindles, which can be alternately operated upon by the segmental nut which is placed between them, and actuated by the lever, substantially as herein set forth."

3. For an *Improvement in Refrigerators of Wort;* Adolph Hammer, Philadelphia, Pennsylvania, September 7.

Claim.—"What I claim as new is, the series of deep, narrow, open chambers, when made with vertical partitions so as to form passages at the bottoms thereof, for imparting to the wort a direction downward and upward, through the said chambers, in combination with shallow chambers, with which the aforesaid chambers successively communicate, and the enclosed chambers, through which flows, in direction opposite to that of the wort, a current of cold water, in the manner and for the purpose herein set forth and shown in the drawing."

4. For an *Improvement in Apparatus for Feeding Chickens;* Simeon W. Albee, Walpole, New Hampshire, September 7.

"The nature of my invention consists in attaching and arranging doors to a suitable case in such manner, that said doors will be opened inwardly by the fowls, when they tread upon steps connected by levers and rods, or their equivalents, to the doors, as will be hereafter described."

Claim.—"I do not claim attaching and arranging the doors to the case, so that said doors will open outwardly, as that has been previously done; but what I claim as new is, attaching and arranging the doors to the case in such manner that said doors will open inwardly instead of outwardly, when the fowls tread upon the steps; the doors being attached to the case and arranged as described, or in any equivalent way."

5. For an *Improvement in Railroad Signals;* Aurin Bugbee, Charlton, Massachusetts, September 7.

Claim.—"I do not claim the simple combination of a bell hung to a spring, a cord or chain leading therefrom, and a tripping lever or apparatus, which when moved in one direction, shall pull the cord and cause the bell to vibrate, as this is a well known combination applied to doors, for the purpose of sounding an alarm; but what I do claim as my invention is, the combination of a single bell, a spring, two cords, and two or more tripping arms or levers, as applied to a railway and supporting frame, at a road crossing of such railway, and so that the contraction of one of the two ropes, by change of temperature, or otherwise, may be counterbalanced by that of the other, and not draw the bell laterally out of place, as it would be likely to, were but one rope or wire used.

"And I claim the combination of the weighted or heavy flag, or signal board, with its suspension chains or cords, the windlass barrel, the over balance weight or weights, and suspension cords or chains, the leading cord passing over the pulley, the tripping lever, the spring catch, and its cord, and the tripping lever or arm; all being arranged and made to operate together, substantially as specified."

6. For an *Improvement in Preserving India Rubber;* Frederick Bronner, Vera Cruz, Mexico, September 7.

Claim.—"The nature of my discovery is, by applying the before mentioned quantity of campeche salt or muriate of soda to the rubber, in its sap state, and that by so doing, to prevent putrefaction and fermentation of the juice, to which more especially I confine the claim of my invention."

7. For an *Improvement in Grain Harvesters;* Daniel Fitzgerald, County of New York, New York, September 7.

"*Claim.*—"What I claim is, 1st, the arrangement and combination of two cylinders with each other, for the purpose of cutting, and bringing the cut grain into the middle between them, and delivering the same to the crib, as above described.

"2d, The construction of the cam cutter, and cam fingers so constructed, as to be drawn in, for the purpose of allowing the cylinders to throw the cut grain into the crib, as above described.

"3d, The use of a sloat or channel, to regulate the movement of the fingers, as above described.

"4th, The arrangement and construction of a crib, made to receive from the two cylinders, and hold the cut grain upright, so that it can be readily taken out for binding, in the manner above described."

8. For an *Improvement in the Manufacture of Common Salt;* James P. Haskin, Syracuse, New York, September 7.

Claim.—"What I claim is, the use of a screen, false bottom, or floor, in the vat or pan, containing saline waters, or brine, for manufacturing salt, to separate impurities or bitterings from the salt, substantially as herein described, or any other mode substantially the same."

9. For an *Improvement in the Manufacture of Sulphuric Acid;* Carl Hiwuchs, City of New York, September 7.

Claim.—"What I claim as my invention is, concentrating sulphuric acid in leaden vessels, to the strength of 66° Baume, and at a temperature below the boiling point of the acid.

"I also claim the long conducting and escape pipe, in combination with the agitating apparatus, for condensing the deleterious gases, and preserving a pure and wholesome air in the neighborhood of the establishment."

10. For an *Improvement in Composition of Enamels;* John G. Dunn and Alfred F. Howes, Lawrenceburg, Indiana, September 7.

Claim.—"What we claim as our invention or production is, the enamel herein before described, and of its application to brick and iron."

11. For *Improvements in Apparatus for Heating Feed Water of Locomotives, etc.;* Israel P. Magoon, St. Johnsbury, Vermont, September 7.

Claim.—"What, therefore, I claim as my invention is, to combine the vessel, H, with the deflector, R, the heater, W, and the chimney pipe, P, substantially as described, whereby such deflector shall not only form the bottom of the said vessel, H, but that the smoke

and exhaust steam may be made to heat said vessel, by impinging against the deflector, as specified.

"And I also claim the improvement of throwing the waste steam directly into the heater or vessel, H, and there partially or wholly condensing it, before it is passed into the tank of the tender: not meaning to claim the throwing of it into the tender from the blast pipe, and through a single pipe, connecting the blast pipe and tender, but the combining the tender and the blast pipe, E, and the heater or vessel, H, by pipes, substantially in the manner represented in the drawing, whereby the advantages herein before stated, as well as others, are obtained."

12. For an *Improvement in Whiffle-tree Hook;* Edwin A. Palmer and Adolphus J. Simmons, Clayville, New York, September 7.

Claim.—"What we claim as our invention is, the head, turning upon the shaft, to close the hook, the sliding catch to prevent its opening, and the spring within the head acting upon them; the whole combined and operating substantially in the manner specified."

13. For an *Improvement in Air-Tight Mail Bags;* Charles A. Robbins, Iowa City, Iowa, and Harvey Allen, Allen Grove, Wisconsin, September 7.

Claim.—"We are aware that hinged clasps or clamps have been used for drawing together and keeping closed the mouth of the bag; such, therefore, merely of themselves, we do not claim: but what we do claim as our invention is, forming the jaws of the clasp with a tongue and groove on their inner faces, for crimping in the elastic material of the bag, and causing it to act as packing, in effectually making air and water-tight the mouth of the bag, as herein shown and set forth."

14. For an *Improvement in a Blow Pipe for Dentists, &c.;* Julius Thompson, North Bridgewater, Massachusetts, September 7.

Claim.—"Now I do not claim the connecting a common blow pipe with a bellows by means of either a flexible or inflexible tube; nor do I claim the invention of a lamp for blow pipe purposes, which may be operated with a burning fluid, or oil, or any other combustible substance; nor do I claim the use of a gas flame for blow pipe purposes, instead of a spirit or other flame: but what I do claim as my invention is, 1st, The combination in one instrument of the flame of gas or a lamp with a blow pipe, so that both operating together, may be held in one hand, and the flame applied on any spot, in any direction, and for any length of time, at the will of the operator.

"2d, The arrangement of the thumb piece, or its equivalent, in combination with the flame of gas, or a lamp, and a blow pipe, so that while the instrument is held in one hand, a movement of the thumb will adjust the blow pipe to the flame in such a way as to produce any desired variation in the flame, as above described and set forth.

"I do not intend by this claim, as I have intimated above, to restrict myself to the mode of construction herein or above described, but to reserve the right to vary the same as I may deem expedient, while I attain the same ends by means substantially the same."

15. For an *Improvement in Preparing Stone in Imitation of Marble;* Hiram Tucker, Cambridgeport, Massachusetts, September 7.

Claim.—"What I claim as my invention is, the improvement in preparing the surface of the slate, or absorbent stone, or mineral matter, for better receiving and retaining colors, and for its quicker and better induration, than by the ordinary process of baking oil or japan on it; the same consisting in applying a drying oil or vehicle to it, as above set forth, in combination with baking it and charring it, or with burning it thereon, essentially as above specified, the charring or burning the oil being the principal of my invention or discovery, under the circumstances as stated.

"And I also claim the improvement in applying the veining and ground colors to such indurated surface, or other surface, the same consisting in applying the graining colors first, and drying them on, in combination with subsequently covering the whole surface, together with such veining colors with one or more coats of black or other colored japanning, and after the same has been dried, grinding down japanning from the veining colors, and leaving it between them, so as to form a ground as stated."

16. For a *Method of Making Lamp Tops Rivets, &c.;* Luther C. White, Meriden, Connecticut, September 7.

Claim.—"What I claim as my invention is, the method of making lamp tops stoppers, rivets, and other similar articles, from a disk or plate of metal, by bending it and forming it, substantially as described, so that the rim is formed of two thicknesses of metal, and the centre and flanch of one thickness, as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Iron-making Resources of the Kingdom, and the First Process in Iron-Making. By S. H. Blackwell, Esq., of Dudley, F. G. S.*

The lecture commenced with a graceful reference to the Crystal Palace, which had brought so prominently into notice the great iron-making resources of the kingdom, and the extraordinary perfection to which some of the branches of that manufacture had attained, while it illustrated no less how those resources underlie all the departments of our manufactures, and form the basis on which all progress must rest.

The history of the iron trade may be divided into two periods—the first, terminating at 1740, when coal was introduced as fuel for smelting; the second, extending to the present time.

In 1615 there were in the whole kingdom 800 furnaces, yielding 180,000 tons; and in 1740 these had declined to 59 furnaces, producing 17,350 tons. At this period coal was introduced, and the rise was thenceforward rapid; in 1788, 70,000 tons; in 1800, 180,000; in 1825, 600,000; and in 1851, 2,500,000. In the same year, the exports of pig iron were upwards of 1,200,000 tons, besides tin plates, hardware, cutlery, and machinery, bearing a total value of £10,424,139.

The causes of this wonderful increase are mainly three—the rapid expansion of our arts and manufactures; the improvements in machinery; but, above all, the vast supplies of coal and iron contained in our mineral fields, and their happy proximity to each other, by which the ore and the coal for its smelting are obtained from the same working.

A class of ores is likely to prove so important, that some notice of it must be given. It commences on the north-east coast of England, at the river Tees, and stretching through York, Lincoln, Northampton, Oxford, and Dorset shires, is at Lyme-Regis diverted by the granite formations of Devon. Its discovery was first made at Middlesboro', between two and three years ago, where the bed is fifteen feet thick, and contains thirty per cent. of iron; and so low is the cost of its production, that the manufacturers of that district have been enabled to compete with the maker of iron from the Scotch black bands. Some idea of the extent to which this bed will ultimately be worked, may be gathered from the fact, that although the workings have been so recently commenced, 200,000 tons of stone were raised by one firm alone in the course of the past year. This ore differs in appearance and structure from any other, and on this and other accounts, although the existence of the bed in Northamptonshire had been long known, and traces of the ancient workings were to be found, it had been neglected, and it was only by the Exhibition that its extent and value had been ascertained. The supply of this iron-stone may be fairly considered as inexhaustible—that from Higham-Ferrers, in Northamptonshire, where many tracings of ancient workings have been found, yielding 55 per cent. of iron.

The lecturer then proceeded to notice the improvements in the manufacture, by which, in little more than a century, a larger quantity is now

* From the London Practical Mechanic's Journal, July, 1852.

produced by two furnaces than by the whole number in blast in 1740; while, by several single firms, fivefold the whole make of the kingdom at that period is produced.

The reduction in prices resulting from these improvements has naturally been very great, and pig iron has now fallen from 8*l.* per ton, the average in 1820, to 2*l.* 12*s.* 6*d.* It is not uninstructive to remark, that the quantity exported in the past year, with the duty on foreign iron at 30*s.*, is double the entire make of the kingdom in 1825, when the duty was reduced from 6*l.* 10*s.*

Not the least interesting part of this important history, is the consideration of the obstacles opposed by prejudice and ignorance to each successive improvement. Although the use of coal was attempted as early as 1620, the opposition on the part of the workmen was such, that its successful application did not take place till more than a century later. For a long time the most eminent firms refused to make use of the hot-blast, although now more than $\frac{19}{20}$ths of the whole produce of the country are made with it; and the application of the waste gases, although adopted most successfully in Scotland, Derbyshire, and South Wales, has hitherto failed to make its way into South Staffordshire.

An important result of the Exhibition is the acquaintance it has given us with the iron manufactures of other countries, which, in many cases, showed an excellence which we have not yet attained, but which we must reach if our pre-eminence is to be maintained. It is a dangerous mistake to suppose that we are possessed of any exclusive skill in manufacture, or that our immense natural advantages will enable us to retain the position which we hold without straining every nerve to do so. The lecturer concluded by warning the Anglo-Saxon race, "to whom work is less a toil than a passion," that with their faculties and natural privileges, they also bear the responsibility of the progress of the world.—*Proc. Soc. Arts, April* 7, 1852.

For the Journal of the Franklin Institute.

Remarks on the U. S. Steamship Susquehanna. By B. F. Isherwood, Chief Engineer, U. S. Navy.

In 1847, the United States Navy Department commenced the construction of the four steamships-of-war, *Susquehanna*, *Powhatan*, *Saranac*, and *San Jacinto*, all of which are now completed, the latest, the *Powhatan*, having made a trial trip in May last.

The *Susquehanna* left the United States on her first cruise, in June, 1851, for the East Indies, by the way of the Cape of Good Hope, and returns have been received up to January, 1852, which show her to have been signally fortunate on her passage, being favored with fine weather nearly the whole time, and with fair winds during a long portion of it; consequently, she was able to derive very great benefit from the use of her sails. Owing to the same cause, there were no opportunities for testing her steam capabilities, as the engines were not worked with wide throttles and all furnaces in operation for a sufficient length of time to obtain reliable average data; from the same cause, likewise, and the

absence of indicator diagrams, neither the power exerted by the engines nor the performance of the boiler can be accurately determined. The data, however, is furnished for approximate calculations, which the reader can make for himself, and which will be sufficiently near the truth for practical purposes.

For the sake of brevity, the performance of the vessel has been divided and placed under the heads of "*Sail alone with paddles removed;*" "*Sail alone, the paddles being turned by steam to prevent their impeding the headway of the vessel;*" "*Steam assisted by sail;*" "*Steam unassisted by sail;*" each head comprising a sufficient length of time to make the means reliable.

A synopsis of the steam log of the vessel has been tabulated, and the means given for each number of consecutive hours where the weather, sail, steam data, &c., remained constant, and the mean of these means will probably be as correct an expression of the vessel's performance, as it is possible to obtain.

The synopsis of the steam log given in the tables, includes *the whole* of the vessel's performance recorded in that log.

In the table of the "*performance under steam assisted by sail,*" it will be observed that the conditions of the vessel on the first and last line are very nearly alike, the speed of the vessel being the same; but for the time recorded on the first line, a reduced steam power was used, and the wind was allowed to act; while for the time recorded on the last line, a greatly increased steam power was used; and as the wind was on the quarter, the vessel was driven by the steam as fast as the wind followed; the latter was, consequently, without effect, which is proven by the vessel having only the same speed as before, and also by the slip of the wheels being nearly equal to their mean, when under steam alone: the slip in the former instance being only two-thirds of the mean under steam alone.

It is believed a correct account of the dimensions of the vessel and machinery, &c., &c., together with her performance, will be a valuable addition to our statistics of large ocean steamships, and a reliable guide on many points of proportion, &c., for vessels of her class and model.

Hull.

The hull of the *Susquehanna* is built of live oak, with white oak planking, and braced with wrought iron braces, 4 inches broad by $\frac{3}{4}$ths of an inch thick. The braces are in one direction only, descending at an angle of 45 degrees from the centre, both ways, to the ends, and are placed five feet apart between centres horizontally; the hull is filled in solid above the turn of the bilge and fore and aft; the vessel is barque rigged, and in the principal sails spreads 21,230 square feet of canvass.

Length from forward side of rabbet of stem to aft side of rabbet of post, at a draft of water of 18 feet 6 inches,	250	feet.
Length for Custom House Measurement,	257	"
Extreme breadth,	45	"
Depth of hold,	26½	"
Burthen by Custom House measurement,	2452 tons.	
Extreme breadth over guards;	69	"
Height between berth and spar deck, *in clear* of beams,	6¾	"
Depth of keel,	1½	"

TABLES OF THE PERFORMANCE OF THE U. S. STEAMSHIP SUSQUEHANNA.

Performance under Sail alone, the paddle wheels being turned by steam only as fast as was necessary to prevent them from impeding the Vessel's speed.

Date. 1851.	Number of consecutive hours.	Speed of the vessel per hour, in knots of 6082⅔ feet.	Course of the vessel.	Wind. Direction.	Wind. Kind.	Sail.	Sea.	Draft of vessel. Forward.	Draft of vessel. Aft.	Draft of vessel. Mean.	Immersion of lower edge of paddle.	Engines. Steam pressure per sq. in. in lbs. above atmos.	Engines. Double strokes of piston per minute.	Engines. Steam cut off at from commencement of stroke.	Engines. Back pressure in condenser per gauge.	Engines. Proportion of throttle open.	Boilers. Number of furnaces of the boilers in operation.	Boilers. Pounds of coal consumed per hour.	Boilers. Kind of Coal.	Speed of the vessel in feet per hour.	Speed of the centre of pressure of the paddles in feet per hour.	Slip of the centre of pressure of the paddles per centum.
								ft. in.	ft. in.		ft. in.	lbs.			lbs.							
Nov. 23 to 27.	108	7·732	—	From abeam to aft.	Gentle breeze.	All sail set.	Smooth.	18 0	18 4½		5 8	7·7	8·520	½	2	0·14	6 for 12 hs. and 4 for 96 hours.	1674	Mixed patent fuel and Newcastle.	47031·18	45169·63	
Nov. 30 to Dec. 2.	56	7·259	N. N. W.	N. E. abeam.	Light breeze.	"	Smooth.	16 7	18 5		4 6	5·3	8·349	"	2	0·15	4	1762	Do. do. do.	45836·01	44154·16	
Oct. 4 to 7.	84	8·865	E. S. E.	S. W. abeam.	Moderate gale.	"	Heavy aft.	18 7	18 9		6 4	7·0	8·636	"	2	0·16	6	2054	Cumberland bituminous.	53922·84	47411·64	
Oct. 10 to 15.	124	8·500	S. E.	N. and W. or aft.	Moderate breeze.	"	Moderate.	16 3	18 6		4 4	7·2	9·078	"	2	0·16	4 for 72 hs. and 6 for 52 hours.	1629	Do. do. do.	51702·66	55838·22	
Sept. 2 to 6.	84	8·000	E. S. E.	W. S. W. on quarter.	Moderate breeze.	"	Moderate.	18 1	19 2		6 4	7·0	8·220	"	2	0·13	6 for 60 hs. and 4 for 24 hours.	1900	Newcastle bituminous.	48661·33	45127·80	
Sept. 12 and 13.	36	9·417	N. N. E.	E. or on quarter.	Fresh topgal'nt bre.	"	Smooth.	16 7	18 10		4 8	7·6	10·155	"	2	0·16	6 for 24 hs. and 5 for 12 hours.	1962	Do. do. do.	57280·47	55750·98	
Means,		8·234		From aft to abeam.	Moderate breeze.	All sail set.	Ordinary.	17 4	18 8		5 4	7·1	8·73	⅓	2	0·15	5	1797	Bituminous.	50084·68	47927·70	

Performance under Steam assisted by Sail.

June 6 and 7.	16	8·000	S. W.	E. or on quarter.	Moderate breeze.	All sail set.	Smooth.	19 2	19 5	19 3½	6 3½	7.2	9·950	·5	2	·11	7 for 8 hs. and 6 for 8 hours.	2775	Cumberland bituminous.			12·77
July 21 to 25.	104	9·190	S. W. by S.	S. E. or abeam.	Moderate breeze.	Sail to top-sails.	Smooth.	17 11	18 2	18 0½	5 0½	7·6	11·430	·5	2	·25	8 for 60 hs. 9 for 32 hs. and 7 for 12 hours.	3317	Do. do. do.			10·78
June 9 to 16.	180	8·000	E. by S.	S. W. or on quarter.	Gentle breeze.	All sail set.	Smooth.	18 4	19 1	18 7½	5 7½	8·3	10·935	·5	2	·32	12 for 96 h. 10 for 24 h. and 8 for 60 hours.	3433	Do. do. do.			18·94
Means,		8·413		From quarter to abeam.	Gentle to moder. br.	All sail set.	Smooth.	18 3	18 9½	18 6	5 6	8·0	11·054	·5	2	·28	9·43	3358	Cumberland bituminous.			

Performance under Steam unassisted by Sail.

June 8 and 9.	20	6·625	E. S. E.	S. S. E. or on bow.	Moderate breeze.	None.	Moderate.	19 11	20 2	20 0½	7 0½	10·0	87·900	½	2	·75	12	4084	Cumberland bituminous.			21·22
June 17 to 24.	189	7·335	E. S. E.	E. or on bow.	Moderate breeze.	None.	Smooth.	16 9	17 11	17 4	4 4	7·7	10·480	"	2	·30	8 for 24 hours. 9 for 93 hs. and 10 for 72 hs.	3565	Do. do. do.			22·45
July 5.	19	7·895	S. W.	S. W. or ahead.	Moderate breeze.	None.	Smooth.	19 3	19 6	19 4½	6 4½	9·3	11·230	"	2	·50	10	4270	Do. do. do.			22·10
July 16 to 18.	48	7·800	S. by W.	S. by W. or ahead.	Gentle breeze.	None.	Moderate.	17 9	18 6	18 1½	5 1½	10·4	10·730	"	2	·70	12	4288	Do. do. do.			19·46
July 18 to 20.	60	8·390	S. W. by S.	S. E or abeam.	Moderate breeze.	Fore & Aft.	Moderate.	17 5	18 2	17 9½	4 9½	8·3	11·500	"	2	·31	9 for 34 hours. 10 for 10 h. and 6 for 16 hours.	3808	Do. do. do.			19·18
July 24 to 26.	32	8·220	S. W. by W.	Variable.	Light airs.	None.	Smooth	16 8	17 6	17 1	4 1	6·7	11·250	"	2	·25	10 for 12 h. and 9 for 20 hours.	3340	Do. do. do.			19·05
September 1 and 2	34	6·574	E. S. E.	On bow.	Gentle breeze	None.	Mod'tly heavy.	19 3	19 6	19 4½	6 4½	10·0	8·840	"	2	·625	8	3968	Duffryn, (Welsh)			17·60
September 7 to 11.	112	7·634	E	N. E. by E. or on bow.	Moderate breeze.	None.	Moderate	17 11	18 8	18 3½	5 3½	8·5	10·326	"	2	·35	6 for 32 hs. and 8 for 80 hours.	3183	Do. do. do.			18·19
Sept. 11 and 12.	20	7·712	N. E.	E or on bow.	Moderate breeze.	Fore & Aft.	Smooth.	17 9	18 7	18 2	5 2	9·0	10·766	"	2	·25	8 for 16 hs and 6 for 4 hours.	3245	Do. do. do.			20·63
Sept 27 to Oct. 3.	140	7·874	S. E.	E. or on bow.	Gentle breeze	None.	Smooth.	19 3	19 5	19 4	6 4	10·1	10·650	"	2	·43	10	3432	Do. do. do.			18·08
Oct. 8 and 9.	36	8·240	S. E.	S. or on bow.	Moderate breeze.	Fore & Aft	Moderate	18 3	18 5	18 4	5 4	9·0	11·320	"	2	·37	10 for 24 h and 6 for 12 hours	3067	Do. do. do.			19·35
Oct. 30 and 31.	48	7·230	S. E.	S. or on bow.	Moderate breeze.	None.	Moderate.	19 10	19 10	19 10	6 10	10·0	9·700	"	2	·625	8	3956	Newcastle bitumin's			17·42
Dec. 8 to 14.	136	7·037	E. by N	E. N. E. or ahead.	Gentle breeze.	None.	Smooth.	17 11	18 8	18 3½	5 3½	7·8	9·605	"	2	·20	6	2279	Liverpool "			18·83
Dec 21 to 23.	72	6·042	N. N. E	On bow.	Moderate breeze.	Fore & Aft	Smooth.	16 6	17 10	17 2	4 2	8·0	8·507	"	2	·20	6	2120	Do. do. do.			21·31
Means,		7·433		On bow.	Gentle to moderate.	None.*	Ordinary.			18 3¼	5 3¼	8·6	10·259	½	2	·375	8·444	3279	Semi-bituminous.			19·73

*The fore and aft sail producing no perceptible effect.

Position of Centre of Displacement, and of Metacentre, at the following Drafts of Water.

	Feet.	Feet.	Feet.	Feet.	Feet.
Drafts of water,	15·500	16·500	17·500	18·500	19·500
Centre of displacement below water line,	5·833	6·292	6·729	7·167	7·667
Position of cen. of disp. before cen. of water line,	4·583	4·229	3·938	3·667	3·500
Height of metacentre above cen. of grav. of disp.,	13·583	12·704	11·896	11·208	10·621

Displacement and Areas of Immersed Amidship Sections at the following Drafts of Water.

Mean Drafts of Vessel.		Immersed Amidship Sections.	Displacements.
Ft.	*In.*	*Square Feet.*	*Tons of Sea Water.*
15	6	549·000	2745
16	10½	610·875	3109
17	6	639·000	3277
17	7	642·750	3300
17	8½	648·375	3336
17	9	650·250	3345
17	10½	655·875	3381
18	6	684·000	3550
19	4	721·500	3683
19	4½	723·400	3791
19	6	729·000	3824
19	10	744·000	3917

ENGINES.—Two inclined, direct acting, condensing engines, with inclined air pumps:
- Diameter of cylinders, ... 70 inches.
- Stroke of pistons, ... 10 feet.
- Space displacement of both pistons per stroke, . . 534·51 cubic feet.
- The cylinder valves of the balance puppet kind, the steam valve being made the cut-off valve by Stevens' arrrangement; the steam space between the cut-off valves and pistons in *one* end of the *two* cylinders is, . . . cubic feet.

PADDLE WHEELS, of the common radial kind.
- Diameter from outside to outside of paddles, . . 31 feet.
- Length of paddles, ... 9 feet 6 inches.
- Width of paddles, ... 34 "
- Area of *two* paddles, ... 54 square feet.
- Number of paddles in each wheel, . . . 26
- Immersion of lower edge of paddles at 18 feet draft of water, 5 feet.

BOILERS.—Four copper boilers, with double return ascending flues.
- Length of each boiler, ... 15 feet 9 inches.
- Breadth of each boiler, ... 15 feet.
- Height of each boiler, (exclusive steam chimney,) . 12 " 9 "
- Total area of heating surface in the four boilers, . 8652 square feet.
- Total area of grate " " " . 342 "
- Aggregate cross area of the first row of flues in the four boilers, 82 "
- Aggregate cross area of the second and third row of flues in the four boilers, (each,) . . . . . 52 "
- Cross area of the chimney, ... 54 "
- Number of furnaces in the four boilers, . . 12
- Height of smoke chimney above grates, . . 65 feet.
- Weight of the four boilers and appurtenances, 184·4 tons.
- Weight of sea water in the four boilers, . . . 126 tons.

Total length occupied in the vessel by the machinery, from bulkhead to bulkhead, 102 feet 9 inches, including a forward coal hold of 12 feet 9 inches fore and aft; the length occupied by engines, boilers, and fire rooms, is 90 feet; the bunkers stow 900 tons of coal.

Statistics of the Machinery of the Susquehanna.

	Weight of material in a finished state. lbs.	Finished Surfaces. sq. in.	Labor. No. of Days.	Total Cost. Dolls. Cts.
Engines (complete) with paddle wheels, engine room, floor, &c., &c.				
Weight of material in a finished state.				
Cast iron, 350,688 lbs.				
Wrought iron, 310,544 "				
Brass Composition, 54,596 "				
Copper, 21,398 "				
Steel, 1,776 "	739,002			
Finished Surfaces.				
Planing, 81,541 sq. in.				
Boring and turning, 662,859 "		744,380		
Day's Labor.				
Number of days' work fitting, 19,562				
No. of days' work of laborers, 1,161			20,723	165,085·82
Boilers.				
Weight of material in a finished state.				
Copper plates and bolts, 313,845 lbs.				
Brass composition, 10,437 "	324,282			121,481·67
Appurtenances to boilers, viz: smoke pipe, jackets, holding down bolts, furnace and flue doors, grate bars, safety, feed, blow, and steam stop valves, water pans, fire room floor, &c., &c.				
Weight of material in a finished state.				
Cast iron, 60,783 lbs.				
Wrought iron, 20,684 "				
Brass composition, 4,832 "				
Copper, 2,652 "	88,951			
Finished surfaces.				
Planing, 5,365 sq. in.				
Turning and boring, 20,998 "		26,363		
Days' labor.				
Number of days' work fitting, 286				
No. of days' work of laborers, 227½			513½	8,973·44
Coal bunkers and bulkheads, engine room, galley, &c.				
Weight of material in a finished state.				
Cast iron, 19,121 lbs.				
Wrought iron, 99,281 "				
Brass composition, 461 "	118,863			13,909·14
Patterns.				
Days labor on patterns, 2219			2,219	7,867·43
Duplicate pieces, tools, stores, outfits, &c.				
Weight of material in a finished state.				
Cast iron, 55,910 lbs.				
Wrought iron, 9,813 "				
Composition, 6,631 "				
Copper, 471 "				
Steel, 59½ "	72,884½			
Finished surfaces.				
Planing, 732 sq. in.				
Turning and boring, 1040 "		1,172		
Days' labor.				
Number of days' work fitting, 377				
No. of days' work of laborers, 10			387	7,363·47
Totals,	1,343,982½	772·515	23,842½	$324,680·97

PERFORMANCE.

Performance under Sail alone, with Paddles removed.

The performance of the *Susquehanna* at sea, under sail alone, with the paddles removed, was for three consecutive days as follows, viz:

July 8,	1851,	178·25 knots.
July 9,	"	174·00 "
July 10,	"	175·00 "

Mean speed per hour, 7·323 knots.

During this period, the course of the vessel was S.W.$\frac{1}{2}$W.; the wind was a moderate breeze from N. E., or directly aft. All sail was carried that could be advantageously set.

With the course of the vessel and the strength of the wind, as above, but the direction of the wind being from the E., or on the port quarter, all sail set as before, the speed of the vessel was as follows, viz:

July 11,	1851,	150·50 knots.
July 12,	"	159·25 "
July 13,	"	159·50 "

Mean speed per hour, 6·517 knots.

On the 14th July, 1851, the course of the vessel and direction of the wind being the same as in the last paragraph, but the wind being only a light breeze, the vessel made but 99 knots, or 4·125 knots per hour.

Throughout all the above sailing, the sea was smooth and the weather fine; mean draft of the vessel, about 19 feet.

The above is all that is recorded in the log of the performance of the vessel under sail alone, with the paddles removed. The paddles, though newly put on, and with copper bolts and nuts, required two hours to take off 11 in each wheel, the sea being smooth and the weather fine.

Performance under Sail alone, the paddle wheels being turned by steam only as fast as was necessary to prevent them from impeding the Vessel's speed.

For the sake of brevity, I have tabulated from the steam log of the vessel, all of her performance under the above conditions.

From the annexed table it will be seen that the means of 492 hours' performance under sail alone, with the paddle wheels turned by steam to prevent their dragging, were as follows, with ordinary sea, moderate breeze ranging from abeam to aft, all sail set, and vessel drawing 17 ft. 4 in. forward, and 18 ft. 8 in. aft; immersion of lower edge of paddles, 5 ft. 4 inches.

Speed of vessel per hour,	8·234 knots.
Steam pressure in boiler per square inch above atmosphere,	7·1 pounds.
Double strokes of piston per minute,	8·73
Steam cut off at from commencement of stroke,	5 feet, or $\frac{1}{2}$
Throttle open,	0·15
Number of furnaces in operation,	5
Consumption of bituminous coal per hour,	1797 pounds.
Consumption of bituminous coal per 24 hours,	19$\frac{1}{4}$ tons.
Excess of the vessel's speed over the speed of the centre of pressure of the paddles,	4$\frac{1}{2}$ per centum.

COST OF THE "SUSQUEHANNA."

Hull,	$310,933
Masts and spare spars,	8,936
Boats,	4,934
Rigging,	18,926
Sails and spare sails,	12,383
Tanks and casks,	4,595
Anchors and cables,	16,212
Furniture,	2,260
Miscellaneous,	1,810
Machinery,	324,681
Armament, three 10 inch guns, and six 9 inch guns,	4,738
Ordnance equipments and stores for three years,	20,240
Engineer's stores,	7,185
All other stores,	14,724
Total cost of vessel equipped and fitted for a three years' cruise,	$752,557

WEIGHTS OF THE SUSQUEHANNA.

Hull, (including wheel houses, guards, engine, keelsons, &c.,)	1704	tons.
Masts, rigging, and sails,	82	"
Boats,	9	"
Cables and anchors,	82	"
Armament,	97	"
Men,	35	"
Tanks, casks, water, and dunnage,	142	"
Provisions,	75	"
Various equipments, galley, furniture, &c.,	20	"
Stores in various departments,	44	"
Total weights in steam department except coal,	726	"
Coal in bunkers,	900	"
Total weights,	3916	"

For the Journal of the Franklin Institute.

On the Telegraphic Lines of the World. By DR. L. TURNBULL.

Continued from page 138.

FRANCE.

The French are inferior in telegraphic enterprise to most of the other European countries. In that country the telegraph is under the control of government officers, and all the government business is done by signals, understood by those only who are in the pay of the government; the tariff is too high, and but little use is made of it, as the existing government does not wish it brought into general use: this is much unlike the republicanism of the U. States. The principal instruments in use are those of Brèquet and Foy, which prints from 10 to 12 signs per minute; this is used along the railroad from Paris to Rouen. Wheatstone's needle telegraph and also the instruments of Dugardin and Gardiner are made use of. That of Brett is employed on the connecting line of England and France, between Dover and Calais, and Bain's Chemical Telegraph has more lately been introduced. The lines mostly originate in Paris, from which they stretch northward to Amiens, Arras, Valenciennes, Douae, Lille, Dunkirk, Calais, and Boulogne. South, they extend to Orleans, Louis,

Chevres, Angiers, Blois, Bourges, and Chateauroux; East, to Chalons, on the main; West, to Versailles, Rouen, Havre, and Dieppe: the whole extent being from 400 to 600 miles. Another line is about to be, or is opened from Paris to Lyons. In last April, the government published the establishment of several offices on each line which could be used for private correspondence; there were six of these points on the northern line, the same number on the southern, two on the western, and one on the eastern. The committee appointed for the purpose, recommended a general distribution of them on all the lines. The government have adopted the following tariff of charges, for a despatch of twenty words, including the names of the sender:—

From Paris to Arras,	4 f.	80 c.	From Paris to Angers,	5 f.	88 c.
" Valenciennes,	5	64	" Bourges,	7	60
" Lille,	6	36	" Nevers,	5	88
" Calais,	6	36	" Chateauroux,	6	72
" Dunkirk,	7	56	" Chalons,	6	24
" Orleans,	7	32	" Rouen,	5	70
" Tours,	4	56	" Havre,	5	76

To estimate the expense between each of these places, it is only neces sary to find the difference of that between them and Paris respectively. For despatches of more than twenty words, a fourth is to be added for every ten words, so that this tariff will be double for sixty words.

I have translated the following list of the lines of France, from the "Traité de Telegraphic Electrique," by Moigno, second edition, 1852.

1st, Line of the North, from Paris to Valenciennes, by Amiens, Arras, Douae, Lille, with a branch to Dunkirk, Calais, and Boulogne, 90 leagues.

2d, Line of the South, from Paris to Chateauroux, by Orleans, Blois, Tours, Bourges, with a continuation to Bordeaux one way, and another to Nantes.

3d, The line of the East, from Paris to Chalons sur Marne, prolonged to Strasburg, by Vetoy, Nancy, &c.

4th, The line from Paris to Havre, by Rouen and Dieppe.

5th, The line of Montereau to Troyes.

6th, The line of Metz to Nancy, &c.

The entire length of the finished lines form three hundred leagues, (about 750 English miles,) and according to Moigno, they have committed the irreparable fault of suppressing the old telegraphs.

Holland.

The instrument used in Holland is a modification of Morse's by Mr. Wm. Robinson; this gentleman is an American; he has obtained the privilege of erecting and managing lines of magnetic telegraph, in the United Kingdoms of Norway and Sweden, for fifty years. A company of heavy capitalists of this city and Stockholm, have commenced in the work, which is to begin immediately. A similar privilege is expected from the Government of Denmark. Most of the Belgian and Holland Railroad Companies have constructed telegraphs; there is one now in operation from Amsterdam to Rotterdam, and the Government of Holland has authorized the construction of one from Amsterdam to the Helder, and one from Rotterdam to Vleissingin.

Italy.

Considerable progress has been made in the construction of lines throughout the Italian States. By virtue of an ordinance of the Minister of Public Works, the telegraphs which are to connect Rome on one side with Cevita Vecchia and the sea, and on the other side with the Austrian boundary at Ferrara, will be established at an early day.

Spain.

In Spain, the line from Aranjuez to Madrid is complete, and others are being laid down to Seville, Cadiz, Valenten, Barcelona, and the frontier of France. Before long there will be a general telegraphic communication from one extremity of Europe to the other, and when the connexion between Dover and Calais shall have been completed, the people of London will be able to communicate with those of nearly every capital on the continent, extending over a space of nearly 6000 miles.

Russia.

A Prussian engineer has gone to St. Petersburg, in order to establish electro-magnetic telegraphs throughout the whole Russian monarchy.

Mexico.

A contract has been entered into by the Mexican Government, with Wm. George Stewart, Esq., the Mexican Consul at New York, and Senor Juan de la Grariga, of Mexico, to construct a line from Vera Cruz to the City of Mexico, a distance of three hundred miles; one hundred and twenty of which, as far as El Oge de Argua, was to have been completed on the 1st of May, 1851. Another line will soon be built between Acapulco and the City of Mexico. When both are completed, there will be a magnetic communication between the Atlantic and Pacific.

A letter from Mexico informs us of the progress of the magnetic telegraph in that country. It appears that the party who went from the U. States to that country for the purpose of putting up a line of telegraph from the City of Mexico to Vera Cruz, have finished it from the former city to Napolucan, a distance of about 150 miles, and half way to Vera Cruz. The other half will be finished in two and a half months. The line already up is doing a very fair business; the receipts averaging $35 per day, and the expenses about $15. These receipts will be largely increased when the line is finished to Vera Cruz, as the largest portion of the business transactions of the country is between that City and the City of Mexico, including Puebla and Orizaba. Another line is in contemplation from the City of Mexico to Acapulco, on the Pacific, 300 miles further, which will connect the Atlantic and Pacific. This will be a highly important connexion, considering our California possessions on the Pacific.

Mexican advices to Sept. 4th, says: Sr. Don Juan de la Granja has finished the telegraphic line from Vera Cruz to Mexico, and is about to undertake the construction of another line from Mexico to Guanajuato.

Cuba.

The Governor General has ordered the publication of the concessions made to companies for the establishment of electric telegraphs through all points, and to the principal cities of Cuba. The lines will be established

from Villanueva to Union, crossing several small towns in their way; from Union to Matanzas; from Buerba to Macagua; from Tinguaro to Jucaro; from Navagas to Isabel; from San Felipe to Batabano, and from Rincon to Guanajay, by San Antonio. The companies will be obliged to commence the works six months after the date of the concession, and to establish them with the greatest possible activity.

The Cubaneras have discovered the benefits the magnetic telegraph confers by facilitating business and transmitting communications from one point to another. They are, therefore, setting about establishing telegraph lines throughout the Island. Two companies have been formed for this purpose. One of these companies, with a capital of $20,000, propose a line from Havana to Cienfuegos, passing through Isabel, Trinidad, and Manzanillo, to Cuba. From this point it will be extended to Bayams, and thence to Guanagos and Pinar del Rio, ending at San Juan and Martenez. The second line, which also starts from Havana, will communicate with Cardenas, Matanzas, Siena, Morena, Sagua la Grand, San Juan de los Remedios, Neuvitas, Moron, and Halguin, and will end at Cuba, having three branches to Puerto Principe, Sancto Spiritus, and Villa Clara. The same company propose a line from Havana to Hariel, Cubanas, and Bahia Honda; the capital of this company is $300,000. These lines, when completed, will connect the capital with every considerable town on the Island.

Valparaiso.

The telegraph between Valparaiso and Santiago, is progressing rapidly. Messages have already been sent over one-third of the line, (from Casa Blanca to this city.) From present appearances, the line will be through in less than forty days, as the poles are already up more than three-quarters of the distance.

India.

This all-infusing enterprise has aroused the lethargic inhabitants of the tropical climate. An electric telegraph has been erected in India, and is now in successful operation: the telegraph will soon belt both continents.

On the Influence of Sulphur upon the Nature of Cast Irons. By M. Janover, Director of the Blast Furnaces of Orme.*

In the present memoir I shall describe some experiments which I have made in order to ascertain the influence which sulphur exercises upon the nature of cast irons. All works on metallurgy, which have treated of the action of the simple non-metallic bodies upon cast iron, point out, it is true, the tendency of sulphurous ores to produce white metal in their treatment in the blast furnace, but not one gives any information respecting the mode of action of the sulphur. It is generally admitted that sulphur renders cast iron too fusible, and consequently difficult to convert into gray metal. This explanation, which has some truth in it, is not sufficient, seeing that very gray cast iron may be easily produced with highly phosphorized, and consequently very fusible ores. The disinte-

* From the London Chemical Gazette, June 15, 1852.

grated oolitic ores of Villebois and of Tremblois, which contain a large proportion of phosphorus, furnish tolerably good results. It is necessary to admit, independently of the great fusibility, some chemical action of the sulphur,—a decarbonizing action upon the iron.

The charge for the blast furnaces of Orme, situated in the coal basin of the Loire, consists essentially of two kinds of ores, viz:

Compact peroxidized ore of Privas.		Carbonated ore of the coal measures.	
Clay,	16·55	Clay,	73·15
Peroxide of iron,	70·05	Protoxide of iron,	37·02
Lime,	5·88	Sulphuret of iron,	5·98
Water and volatile substances,	7·52	Lime,	0·86
		Magnesia,	0·55
	100·00	Water and volatile matters,	42·00

The first is a compact ore, of an average degree of reducibility, and tolerably fusible; the second is both easily reducible and fusible, but it contains much sulphur; the gangue of both is argillaceous.

Of these two ores, that of the coal measures (especially when calcined,) presents, excepting the sulphur, all the conditions essential for gray cast iron with large and open grain; and to protect it from the great fusibility of the sulphurous cast irons, and preserve it from the action of the sulphur and silicon, which weaken the tenacity, I treated this ore with a large proportion of lime, in order to facilitate the formation of a sulphuret of calcium and a silicate of lime, and thus to get rid of these two injurious substances.

The first day, the blast-furnace working hot and very regularly, gave a very gray iron; but the nature of the product soon changed; the iron became porous (*truitée*), fibrous, white, and lastly cavernous, granular and white, although the working of the blast-furnace remained good and regular.

I had not to fear an incomplete reduction, owing to the great fusibility of the sulphuretted irons (fusion before reduction), for the corresponding slag was white, stony, and without a trace of protoxide of iron. There was no variation in the atmosphere; the blast applied preserved the same temperature and pressure; there was no alteration in the combustible, nothing, in fact, which would account for such a change in the product. I then attributed the change observed to a cooling of the lower part of the furnace, owing to the formation of the excessively basic slags which I sought to produce. Their analysis gave—

Silica,	34·50	
Alumina,	18·00	(without a trace of iron.)
Lime and magnesia,	47·00	
Sulphur,	0·13	
	99·63	

To obtain a less basic slag less difficult to fuse, I progressively diminished the amount of lime. The working of the furnace continued constantly hot and regular; but the iron, instead of improving, became more and more cold. On being run from the furnace, a loud decrepitation was audible, and it quickly solidified; on fracture, it was coarse and sometimes cavernous; it exhibited in every respect the character of a cast iron produced with a cold working, the carburation being imperfect, although the appearances

of the working, of the slag, the flame at the throat of the furnace, indicated the contrary. By diminishing the amount of flux without varying the other elements of the slag, I restored to the crucible the heat which might have been abstracted by the formation of too basic a slag; on the other hand, I isolated a larger amount of sulphur; the product became worse and worse, so that I was led to attribute to the sulphur alone the deterioration of the cast iron. I imagined that the whitening of the iron was due to the subtraction of a part of the carbon of the cast iron in the form of sulphuret of carbon, and to the heat rendered latent by the volatilization of this body. I then made various synthetical experiments, in order to prove this kind of action of the sulphur upon the carbon of the cast irons.

3 grms. of a beautiful large-grained gray iron were treated with *aqua regia*, and the solution mixed with chloride of barium; I obtained 0·02 sulphate of baryta = 0·0027 gr. sulphur, or 0.09 per cent. of the weight of the cast iron.

Knowing exactly the amount of sulphur, I re-smelted—

1. 32 grms. of this same metal with 0.64 of pyrites (bisulphuret of iron), perfectly crystalline and without gangue.

2. 40 grms. with 0·40 pyrites, to see whether this iron, after whitening, would contain more sulphur, and how much it would increase or diminish in proportion as the amount of pyrites was increased or diminished. When the material was fused and very liquid, I uncovered the crucible, and perceived some brilliant globules of a more intense white than the fused metal, which were disengaged between the sides of the crucible and the metallic button, and disappeared on contact with the air, producing at this spot a very perceptible lowering of the temperature. When the disengagement had ceased, I let the metal cool very slowly in the crucible in which it had been fused, to be certain that the whitening did not proceed from a too sudden cooling. Notwithstanding this precaution, the metal, which till then had remained tranquil with a smooth surface, opened in all directions, produced a loud decrepitation, and became covered with an uneven crust, which separated partly from the metal, and presented in every respect the characters of a granular iron produced by an imperfect carburation in a bad working. When broken, the cast irons were white, and the more so in proportion to the amount of pyrites. They were excessively hard; a file of cast steel would not act upon them.

I examined these white metals. 3 grms. of each were treated with *aqua regia*, and the solution mixed with chloride of barium. The first gave 0·19 grm. sulphate of baryta = 0·026 of sulphur = 0·87 per cent. of the weight of the metal. The second gave 0·10 sulphate of baryta = 0·0133 of sulphur = 0·46 per cent.

From these two assays, it will be seen that the cast iron contains, after this fusion, a greater proportion of sulphur, and that this proportion increases almost in the same relation as that of the pyrites added, since in the first case we find nearly twice as much sulphur as that given in the second experiment, which contained exactly half the amount of pyrites. This is what I expected in some measure, for the pyrites lose by heat the half of its sulphur on being changed into more stable protosulphuret, and the affinity of the sulphur for the iron would necessarily give rise to

the combination of the sulphur set free with the metal. The composition of the pyrites is—

Sulphur,	54·26
Iron,	45·74

An assay in the dry way, made with the mixture of 2 per cent. pyrites, contained before fusion 1·06 per cent. of sulphur; if the half, which was disengaged from the bisulphuret by heat, had combined entirely with the metal, I ought to have found the same amount of sulphur, whilst analysis only gave 0·87 per cent., from which must still be deducted 0·09 per cent. which the first cast iron contained, leaving 0·78 per cent. as the entire amount of sulphur which the metal took up in the fusion with pyrites. There was, therefore, a loss in this operation of 0.28 per cent. of sulphur.

The first experiment made with the mixture of 1 per cent. pyrites, which therefore contained before fusion 0·53 per cent. of sulphur, furnished only 0·46 per cent. of sulphur, from which must be subtracted, as in the first case, 0·09 per cent. contained in the metal, leaving 0·37 per cent. In this smelting there was, therefore, a loss of 0·16 per cent. of sulphur.

From the results of these two experiments, it is evident—1st, that the irons contain the more sulphur the larger the amount of pyrites present when they are re-smelted. 2d, that there is a loss of sulphur after complete fusion, and that this loss at a certain time is greater the larger the proportion of pyrites.

These facts once established, it is highly probable, if not certain, that this portion of the sulphur is lost by forming with the carbon of the irons volatile sulphuret of carbon, which produced the brilliant globules observed in the above experiments.

To arrive at a certain proof, I repeated comparatively the experiments previously made by M. Berthier upon a mixture of perfectly clean soft iron filings and pyrites. M. Berthier found, that, by fusing clean soft iron with pyrites, atom for atom, protosulphuret of iron is always formed without any *loss of sulphur*. If this were the case, it is proved that the sulphur lost in the preceding experiments, combined with the carbon of the irons, forming sulphuret of carbon, which had a decarburating action, and produced at the same time some latent caloric by its volatilization; for it is known that on evaporation this liquid produces a decrease of temperature capable of freezing mercury.

I made a first experiment by fusing in a naked crucible before the forge 20 grms. of soft iron filings, well cleansed, with 0·40, *i. e.* 2 per cent. of pyrites. To avoid a slight oxidation by the air which might have entered the crucible, I covered it with a piece of coke; and when the whole mass had arrived at a white welding heat, I uncovered the crucible to see whether in this case there was any liberation of brilliant globules, as in the fusion of the iron with 3 per cent. of pyrites; I could perceive none; the mass remained quiet, and when cold, presented the form of a tolerably compact, uniform button; on being broken, some rather dark yellowish-brown sulphuret of iron was apparent here and there, which was without a doubt protosulphuret disseminated throughout the mass. This first experiment I considered a proof of the forma-

tion of sulphuret of carbon by the fusion of gray iron in the presence of pyrites, as only in this case did I observe the liberation of brilliant globules.

I made a second experiment, in which I determined the amount of sulphur. 2·31 filings of well cleansed iron wire were fused with 2 per cent. of pyrites; I obtained a well-fused compact button, which was easily acted upon by the file. 1·05 was treated with nitro-muriatic acid; it dissolved slowly, but entirely; the solution was precipitated by chloride of barium, and I obtained 0·08 grm. sulphate of baryta, or =1·04 per cent. of sulphur, instead of 1·05 per cent., which the mixture must have contained before the fusion. I thence concluded, as M. Berthier had done, that in the fusion of clean soft iron with pyrites, there is never any loss of sulphur. Therefore, as I have stated at the commencement, we must not attribute to the too great fusibility alone the tendency which sulphurous ores have to yield white irons. The principal cause is due to the formation of a sulphuret of carbon, which acts by decarbonizing in part the metal, and by producing a considerable lowering of the temperature from the caloric rendered latent by the volatilization of this product.

I have stated above, that, on fusing gray metal with variable proportions of pyrites, it became deteriorated, and I have supported this statement by experiments. It remained to be seen whether the same would occur, if, instead of operating upon the cast iron, we were to take the ores. I therefore reduced 20 grms. of the Privas ore with 2 grms. of lime, the whole mixed with 2 per cent. of pyrites in a crucible lined with charcoal. The metal was allowed to cool very slowly in the crucible; but notwithstanding this precaution, the fracture of the button was entirely white, and exhibited in the portion in contact with the slag some yellow plates of sulphuret of iron. Throughout its thickness, it presented large cavities coated with filamentary crystallizations of sulphuret of iron. In the massive portions, the metal had a granular appearance. Altogether, it was very bad, exceedingly brittle, and exhibited not the least elasticity under the hammer.

20 grms. of the same piece of ore, reduced in a lined crucible with 2 grms. of lime and 1 per cent. of pyrites, likewise furnished a very white metal, although cooled very slowly. The button exhibited, like the preceding one, large cavities coated with filamentary crystallizations; the iron was bad and brittle, and without elasticity. The only difference was, that there were no yellow plates of sulphuret of iron perceptible at the junction of the metal and of the slag.

To be certain that, on treatment in the blast-furnace, the pyrites, or rather the sulphur of the pyrites, was an obstacle to the production of a gray metal, I treated 20 grms. of the same piece of ore which had served for the preceding experiments with the same amount of flux without any addition of pyrites. The metal obtained was gray, without, however, being graphitous; it yielded slightly to the hammer, was perfectly compact in the interior, and showed no sulphurous crystallizations. I was, however, able to distinguish with the aid of the lens some minute filaments of sulphuret of iron at the place of contact of the slag with the metal. On analysis, I obtained but a trace of sulphate of baryta.

I now proceeded to determine the amount of sulphur in the metal obtained in the two first experiments, by reducing the ore in the presence of pyrites, in order to see whether also, in this case, acting upon the ores and not on the metal, the latter would contain an amount of sulphur greater in proportion to the quantity of pyrites present. The experiment which had been made with the mixture of 2 per cent. of pyrites furnished, on the analysis of 1 grm., 0·07 sulphate of baryta=0·96 per cent. of sulphur. As the mixture contained previous to fusion 1·06 per cent., we have a loss of 0·10 per cent.

1 grm. of the metal obtained in the experiment made with 1 per cent. of pyrites furnished 0·03 grm. sulphate of baryta =0·41 per cent. of sulphur; since the mixture contained 0·63 per cent. of sulphur, we here again meet with a loss of 0·12 per cent.

It is evident, from these experiments, that the metals contain the more sulphur the more the ores from which they are produced contained pyrites, the proportion of flux remaining invariable.

In order to prevent the injurious influence of the sulphur upon the iron in the treatment of pyritous ores in the blast-furnace, I increased progressively the amount of flux; for, according to M. Berthier, the lime decomposes a considerable quantity of sulphuret of iron at a high temperature in the presence of carbon. In order not to interfere with the fusibility of the slag, I first of all endeavored to ascertain the maximum quantity of lime it might contain. By fusing together the clay and the lime, experiment led me to the following composition as the limit which should not be exceeded:

Silica, ...	36·00
Alumina, ...	10·00
Lime, ...	54·00

Having made this experiment, I obtained, by adding gradually lime to the charge of the blast furnace, a white stony slag containing not a trace of oxide of iron, and approaching closely to the above composition; there were here and there particles of uncombined lime mechanically intermixed. The working of the blast-furnace was constantly good and regular, the combustible very good, and the blast heated to 750°, so as to restore the heat abstracted by this enormous amount of lime.

Notwithstanding this maximum amount of flux added to the charge, I was not able to prevent the action of the sulphur; and to obtain good *gray* metal, it was necessary to subtract a large quantity of the highly pyritous ores of the coal measures.

I next proceeded to ascertain what became of the sulphur on effecting the reduction in lined crucibles. I took:—I. 10 grms. of the ore from Privas, 5 grms. of the slag from the blast-furnace, 5 grms. of lime, and 0·20 of iron pyrites. II. 10 grms. of the ore from Privas, 5 grms. of slag, 10 grms. of lime, and 0·20 of iron pyrites.

The two experiments succeeded perfectly. The first gave a well-fused, vitreous, bright gray slag. However, throughout the portion of the slag which surrounded the button, a hard, whitish-yellow, compact substance, with a smooth fracture, was disseminated. The button of metal was quite white, with a very irregular fracture, very cavernous, and exhibiting a few filaments of a sulphurous crystallization. Three

little balls of metal, which did not adhere to the button, but rested above the slag, had escaped the decarbonizing action of the sulphur; for with a lens, and even with the naked eye, several large laminæ of graphite were perceptible, and the metal was perfectly black. The mixture of the ore, lime, and pyrites not having been perfect, a small quantity of the ore had been reduced, protected from the action of the sulphur, which, on the contrary, had strongly acted upon the button of metal. On analysis, 1 grm. of this white iron gave 0·009 sulphate of baryta = 0·1242 per cent. of sulphur.

The second experiment, in which there was double the amount of flux—the maximum quantity of the fusibility of the slag,—furnished a grayish-white slag filled pretty uniformly with the yellowish-white substance, which in the previous experiment had occurred here and there disseminated in the scoria; it had a shining yellow appearance, and when exposed to moist air, fell for the greater part into a powder, and furnished an enormous quantity of quick-lime. Notwithstanding the powerful affinity which this large amount of lime must have presented for the sulphur, the metal was entirely white, with a granular cavernous appearance, but exhibited no trace of a sulphurous crystallization; it was much more malleable than that obtained in the preceding experiment; it was rather difficult to reduce to powder, and in the mortar flattened out. Although white, it was easy to observe that there was a great improvement in its tenacity. I grm. of this whitish metal gave 0·005 sulphate of baryta = 0·069 per cent. of sulphur, which is scarcely more than half the quantity found in the preceding experiment.

From these two conclusive experiments it is seen, that the amount of sulphur in cast iron diminishes in proportion as the amount of lime contained in the slag increases, but that it is impossible, in certain cases, to remove it altogether without rendering the slag infusible. I have stated, in speaking of the experiment made by fusing 10 grms. of the Privas ore, 5 grms. of slag, 5 grms. of lime, and 0·20 pyrites, that the slag which surrounded the button was altogether compact and yellowish-white, whilst the rest of the scoria was vitreous, and showed nothing similar. The analysis of this portion proves, from the presence of the large amount of sulphur, that some sulphuret of calcium is mixed with the slag; and from its being in immediate contact with the whitened metal, it is evident that the sulphuret of calcium has been formed by some sulphurous emanations from the metal. This slag had the following composition:—

Silica,	40·07
Oxide of iron and alumina,	15·00
Lime,	43·75
Sulphur,	0·50

On comparing the result obtained in the analysis which gave 0·069 per cent. of the weight of the metal with the sulphur previously found in a very gray metal (0·09 per cent.), it is quite evident that the whitening must not be attributed to the sulphur combined with the iron,—sulphur which might form a true sulphocarburet of iron, and prevent the isolation of the graphite. It is owing to the loss of sulphur,—as shown by the two experiments made by fusing at first gray metal, and subsequently clean soft iron with pyrites,—which combines with the carbon,

forming very volatile sulphuret of carbon, and rendering a large amount of caloric latent. Hence we have the whitening produced by two simultaneous actions,—subtraction of a portion of the carbon of the cast irons, and lowering of the temperature from the volatilization of the sulphuret of carbon.

With respect to the position in which the sulphuret of carbon is formed in the blast-furnace, it may be admitted that it is produced wherever the temperature is at a red heat, bearing in mind that Lampadius detected sulphuret of carbon by heating to redness some pyrites and charcoal, and that these conditions occur in the blast-furnace. On the other hand, the analyses of the gases by M. Ebelmen, have not shown its presence, although the latter assumes that probably the sulphur exists in the gases in the sulphuret of carbon, but in inappreciable proportion. We must, therefore, attribute its absence to the highly reductive properties which the sulphuret of carbon possesses, which could not exist in the presence of oxide of iron. In proportion as it was formed, it would be decomposed into sulphuret of iron and oxide of carbon.

It is also possible that the pyrites, on losing the half of its sulphur by heat, yields it to the iron already reduced, converting it into protosulphuret without the formation of any sulphuret of carbon, and we arrive at the same result, that is, the conversion of the iron into protosulphuret in its progress through the furnace.

The flux not having lost the whole of its carbonic acid, does not possess sufficient affinity for the sulphur to decompose the protosulphuret of iron which is constantly being formed. It is only in the neighborhood of the *tuyères*, when the flux has been entirely changed into caustic lime and partially into calcium, that the affinity of the carbon in a nascent state (graphite), together with that of the lime for the sulphur, determines the decomposition of a part of the protosulphuret of iron. There is then formed sulphuret of carbon at the expense of the carbon of the cast iron, and caloric thereby rendered latent. Another portion of the sulphur combines with the calcium.

The sulphuret of carbon formed in the crucible itself, must be again partially burnt by the blast, from which would result sulphurous and carbonic acids, which would reproduce some sulphuret of iron and calcium, and oxide of carbon; and it should be remarked here, that the proportion of sulphuret of calcium will be the more considerable the greater the amount of lime present in the charge. It follows, from this, that in order to obtain a metal which shall contain the minimum amount of sulphur, it is necessary that the slags should contain the maximum amount of lime. I may also add, that in this case the working of the furnace should be as hot as possible, in order to facilitate the isolation of the graphite, and consequently the formation of the sulphuret of carbon, which serves to transfer the sulphur from the metal to the slag.

The author observes, in conclusion, that a considerable improvement has recently been effected in the working of the blast-furnaces and their products by washing the coals, which removes a great portion of the pyrites, and also, by getting rid of the earthy matters, increases the heating power of the coal.—*Annalen des Mines*, Feb. 1852.

For the Journal of the Franklin Institute.

Steamboat Accidents. Loss of the Henry Clay—The Atlantic—The Reindeer.

The reckless mismanagement of steam boilers, which is so constant and just cause of reproach to our country, has been, within the last few weeks, more than usually destructive of life and property. During the earlier months of the year, it was with some trouble that we could keep the run of such accidents on the Mississippi and its tributaries; but it was with an unusual shock that we heard of the first of the accidents to which we intend particularly to refer, in consequence of its taking place on the Eastern waters, which have been comparatively free from such occurrences. The completion of the New York and Albany Railroad, running along the North river, rendered it apparently requisite that unusual efforts should be made by the steamboat proprietors to maintain their popularity, and numerous projects were spoken of, which clearly pointed to fatal results; but up to the 28th July, the railroad had enjoyed a monopoly of accidents, which had been of such frequency as apparently to justify some of our daily papers in keeping the heading, "Accident on the Hudson River Railroad," and similar ones for the Erie and the New Haven roads, in stereotype form. But on the day above mentioned, the steamboat *Henry Clay* was burned on the river, and the event being attended with such a fearful loss of life, as to draw much more than the usual attention to the circumstances, the result has been, to show a want of attention to the safety of the passengers, both in the planning and the management of the boat, which is as disgraceful as it is surprising. The circumstances, as we gather them from the evidence given at the Coroner's inquest, are as follows:—It appears that the *Henry Clay*, which was built to be the "crack" boat, started from Albany at the same time with the *Armenia*, a slower boat, and it soon became evident to those on board, that strong endeavors were made to get and maintain the lead, each of the boats, in turn, passing landings, where the other was engaged in discharging and taking passengers. At length, in a narrow channel of the river, the boats came in contact, not in such a way as to do any great damage, but exciting serious alarm among the passengers, which were crowded upon the *Henry Clay*. To their remonstrances, the officers of the boat, (the Captain, it appears, was sick, and in his state-room,) answered indifferently and impertinently, or answered not at all. The effect of the collision, however, was to cause the *Armenia* to drop astern, and the *Henry Clay* then took and maintained the lead, increasing the distance between them, until about 15 minutes past 3 o'clock, P. M., when the boat was discovered to be on fire, and a feeble and ineffectual attempt having been made to extinguish the fire, the boat was run ashore, below the village of Yonkers, and such of the passengers as could, escaped. After the alarm of fire was given, it does not appear that any effort whatever was made on the part of any officer of the boat to protect the lives of the passengers, or to give any orders by which the panic, so natural on such an occasion, might be avoided or allayed. The fire appears to have originated in the furnace-room, which

is amidships in the hold, and the dense smoke and intense heat soon cut off all communication between the forward and after parts of the boat. The greater part of the passengers, especially the women and children, were, as usual, aft, and the boat being run ashore bows on, (apparently for the especial benefit of the officers, who were in that part of the boat,) those in the rear of the engine were at a distance of some two hundred feet from the shore, and were obliged to commit themselves to the water, which is here deep almost to the very shore, many of them keeping on the wreck until absolutely forced over by the approach of the fire, which burned very rapidly. In this lamentable way, not less than eighty-one persons met their death. The occurrence of the accident on a favorite boat, and in the height of the traveling season, caused its immediate effects to be widely spread throughout our land, and increased the severity of the loss by the destruction of many most valuable lives; among which we especially grieve to record those of Mr. Downing and Mrs. Anne Hill. The loss of these will be more deeply felt, since they have left no one to succeed them in the lines of usefulness to which they had devoted themselves. Mr. Downing's reputation as a landscape gardener was known as well in Europe as here; his labors at Washington and in the vicinity of New York, by introducing a correct taste for the beauties of natural scenery, were invaluable to us, especially because they were directed to the production of results in which we have been heretofore sadly deficient. The same thing is true of Mrs. Hill, who was the Principal of the School of Design for Women, attached to the Franklin Institute. Her sex, her modesty, and the comparatively narrow sphere of her labors, prevented her from being so widely known; but the combination of so many talents, such energy and zeal, with all those virtues and delicacy which characterize a woman, ensured to her the warmest feelings of respect and attachment from those whose good fortune it was to know her. Like Mr. Downing, her tastes led her to the cultivation of arts to which heretofore but little attention has been paid among us, and her loss has left a vacancy which cannot for a long time be filled. The pain at losing such friends is aggravated by the reflection, that they were victims to the recklessness and incapacity of those whose duty it was to sacrifice, if necessary, their own lives for the preservation of their passengers; but we hope that the deep and wide-spread grief will prevent the public indignation from being as ephemeral as is usual in such cases.

As to the immediate cause of the accident, with which the majority of our readers will perhaps think we have most to do, there are many conjectures. It does not appear that any extraordinary effort on the part of the *Henry Clay* was necessary to outstrip the *Armenia;* and it is stated that the time of her trip from Albany gives an average speed of but 16 miles an hour, which is certainly far below her powers. But several of the passengers testified before the Coroner to the unusual heat about her engines, and to peculiar odors, as if from burning highly combustible materials, in the earlier part of the trip. The most probable suggestion which we have heard is as follows: It seems that it is customary with North River boats, on their downward trips, to feed their furnaces off Yonkers for the last time. The furnaces of the *Henry Clay* are in the hold of the vessel, and not on the guards, as usual. The use of anthracite as

fuel requires the blower, and it appears to be well known that when the blast is turned in, it is very apt to force open the fire doors, unless they are very carefully secured. If then we suppose that the fireman had not securely fastened the door after firing, and that the blast drove it open, we should have a powerful jet of flame poured out, as from a gigantic blow-pipe, on the wood work of the fire room, which from continual roasting is very combustible, and the light frame of the boat would catch and burn with almost incalculable rapidity. Such appears to us the most plausible account of the origin of the fire.

In connexion with the presence of one of the owners on board the boat, we give a singular statement from a newspaper, of what has since occurred on the same river. On this occasion there was a race and a collision, and one of the passengers having remonstrated with the Captain thereupon, the Captain told him that *he could not help it; that the son of the owner was on board, and was with the pilot; and that he* (the Captain) *had no authority to direct.* This statement seems to have attracted no notice, but it is really deserving of it, for if true, it points out a state of affairs which would render steamboat traveling almost suicidal.

On the 20th of August, the steamer *Atlantic*, from Buffalo to Detroit, with about 110 cabin passengers, and 270 deck and steerage passengers, and a crew of about 40 men, when off Long Point, (Canada,) and about four miles from the Light House, at 2½ o'clock, A. M., was run into by the propeller *Ogdensburg*, and sank in about fifteen minutes. The loss of life is uncertain, but is estimated at about 200. In consequence of the coolness and presence of mind of the officers, and an efficient provision of life-preserving furniture, the principal portion of the cabin passengers were saved. But the mass of the steerage passengers were Norwegian emigrants, unable to understand what was said to them, and among these the loss of life was fearful. The investigation of the Coroner's jury shews that the lights of the steamer were seen by the watch on board the propeller in time to avoid the accident, and inculpates the mate of the *Ogdensburg*, who will probably be arrested and tried, when we shall report the facts of the case, so far as they are developed.

On Saturday, the 4th of September, the *Reindeer*, another crack North River boat, (which it is said the *Henry Clay* was built expressly to beat, and which had been withdrawn during that unfortunate boat's short life, and returned to her usual trips since her destruction,) burst her boiler as she started from Kingston Point. The part which gave way was the connexion of the return flues, and by the escape of steam 32 persons were killed, and a large number badly scalded. The testimony before the Coroner's jury, shews one of those defects in the iron, which the most careful inspection cannot avoid, and the phenomena of the explosion do not require us to believe that there was any undue pressure of steam in the boiler. The occurrence of the accident immediately after starting the boat, looks as though there were a deficiency of water in the boiler, but the testimony on this point is strong to the contrary. Among the victims of this accident, we regret to record the name of Mr. Woods Baker, an assistant on the Coast Survey, a young gentleman who had distinguished himself by high abilities and zeal in performing his duties, while his amiable character

had endeared him to his many friends. It is a somewhat strange coincidence, that he should have perished in a way so similar to that by which his intimate friend and associate, Mr. Joel B. Reynolds, lost his life, by the explosion of the boiler at Morris' foundry in this City.

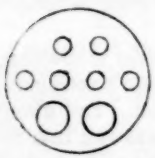
We shall publish the law recently passed by Congress, for the regulation of steamboats, and sincerely trust that its strict enforcement may prevent the necessity of such painful records in future.

EDITOR.

Since writing the above, we have received the following private letter from a friend, who is an entirely competent judge of the matter:

"Though competent witnesses have testified to their belief that the accident was due to defective iron, yet I am persuaded, from what I myself saw, that the true cause of the explosion was probably low water and heated internal flues.

There were six large internal return flues, each about a foot in diameter, and arranged thus:



The diameter of the boiler appeared to me to be not more than eight feet, perhaps less. The depth of water over the two upper flues must have been at all times slight, perhaps not more than two or three inches. It appears highly probable, therefore, that the gauge cocks may have given deceptive results, owing to foam; that the water level fell below the tops of the flues; and, therefore, the explosion while the boat remained at the wharf—the defective iron giving way because it was the weakest point."

Electric Property of Flame. By Prof. H. BUFF.*

The following conclusions are drawn from the experiments described by Prof. Buff:

1. Gaseous bodies which have been rendered conductible by strong heating, are capable of exciting other conductors, solid as well as gaseous, electrically.

2. When a thermo-electric circuit is formed of air, hydrogen, or carburetted hydrogen, alcohol vapor, charcoal, or finally a metal, whether combustible or incombustible, an electric current is developed, which proceeds from the hottest place of contact through the air to the less warm place.

3. The development of electricity which has been observed in process of combustion, and particularly in flame, is due to thermo-electric excitation, and stands in no immediate connexion with the chemical process.

4. The products of combustion do not therefore by any means occupy the relation to the burning body which has been assumed by Pouillet; if positive electricity rises with the ascending gases, it is only in the degree in which the burning body and the air exterior to the place of combustion, or rather exterior to the place of hottest contact, are connected by a proper conductor.—*Annalen der Chemie und Pharm.*, vol. lxxx. s. 1.

* From the Lond., Edinb., and Dublin Philosoph. Magazine, February, 1852.

On the Manufacture of Gas from Wood. By Dr. PETTENKOFER.*

Two years ago, Dr. Pettenkofer showed by experiment, at a meeting of the Polytechnic Institute of Bavaria, that a very considerable amount of illuminating gas could be disengaged from 2 oz. of wood. Its practicability on a large scale has since been the subject of much doubt. The inventor's process is now in operation at Basle, and it is also about to be introduced at Zurich, Stockholm, and Drontheim. The process is said to be far less expensive than the manufacture from fossil-coal, and furnishes a gas which is free from sulphuretted hydrogen, and several useful collateral products, as charcoal, wood-tar, and wood-vinegar.—*Central Blatt., March* 10, 1852.

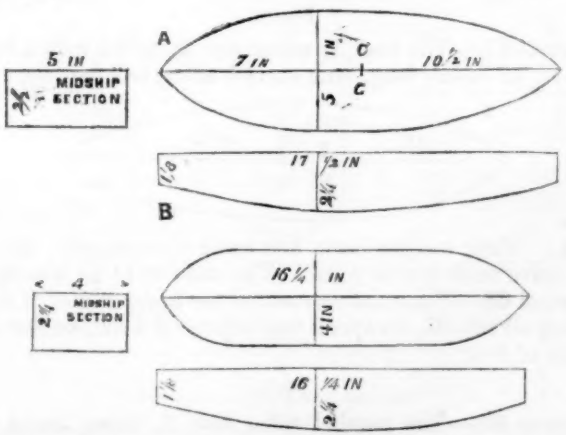
Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By MR. WILLIAM BLAND, *of Sittingbourne, Kent.*†

Continued from page 182.

Having terminated the experiments relating to the midship section, and lee-way or lateral resistance, it will not be departing from the subject in view, to introduce in this place a few examples of floating bodies varied in their dimensions, and comparing their respective speeds.

First.

Diagram A, a boat, 5 inches wide, 17½ inches long, having curvilinear sides; weight, 25 oz.; compared in speed with B, a boat 4 inches wide, 16¼ inches long, with parallel sides; weight, 25 oz. Both these boats had their bottoms curved upwards from their midship sections to their load water lines.



Experiment 63.—The boat A, beat B, in speed by 6 oz. additional

* From the London Chemical Gazette, May, 1852.

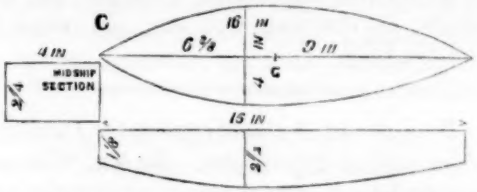
† From the London Civil Engineer and Architect's Journal, October, 1851.

weight: that is to say, to cause the speed of both to be equal under the same drawing force. The stability of A, equalled 5 oz.; that of B, 3 oz.

Second.

Experiment 64.—The boat A, compared in speed with a boat C, after the form of a bird, being 4 inches wide at midship, 16 inches long, having its bottom curved up the same as A, and of equal weight, being 25 oz. The boats, A and C, were equal in speed. The stability of A equalled 5 oz.; that of C, 2 oz.

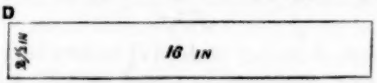
Experiment. 65.—But when C had the angles between the bottom and



sides removed and smoothed down, C then beat A by 4 oz. extra weight. But the stability was, in consequence, reduced from 2 oz. to $1\frac{3}{4}$ oz.

Third.

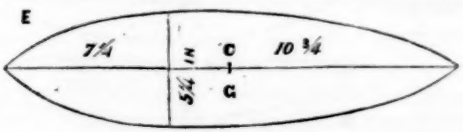
Experiment 66.—The boat C, was compared in speed with a boat of the precise form, but with the bottom not cut up, being left flat as in the



diagram, D. The weights equal, and being in this instance 22 oz. The boat C, beat D, by 12 oz. extra weight. Stability of C equalled 2 oz.; and that of D, 2 oz.

Fourth.

Experiment 67.—The boat A, was tested in speed with a boat E, $5\frac{1}{4}$ inches wide, 18 inches long, with curved sides, and bottom curved the



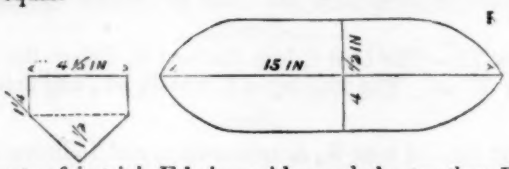
same as A. Their weights being first made to correspond, the trial upon the water gave their speeds equal. The stability of E, was $5\frac{1}{4}$ oz.

Experiment 68.—Upon the removal of the lower angles of the boat E, and making all smooth, its speed was improved 4 oz., so that it beat A, by the sum of 4 oz.

Fifth.

Experiment 69.—The parallel sided boat B, being tested against a parallel sided boat F, with triangular form of midship section, in width $4\frac{1}{2}$ inches, and in length 15 inches, with the weight of each $21\frac{1}{2}$ oz.; the form of bows the same. Being attached to the two arms of the balance rod, and drawn through the water, the result gave 4 oz. in favor of B;

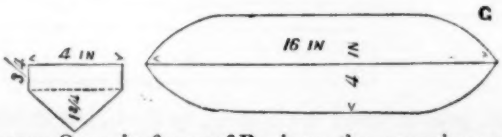
that is, the additional weight of 4 oz. was put into B, which then rendered their speeds equal.



This was not a fair trial, F being wider and shorter than B. The stability of F, equalled $2\frac{1}{2}$ oz.

Sixth.

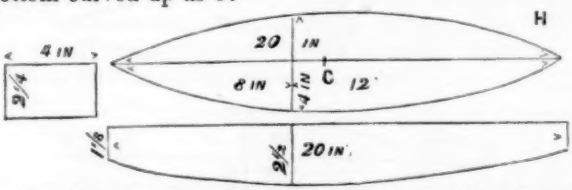
Experiment 70.—The boat B, was again tested with another boat, G, the midship section being a triangle; the length and breadth the same as B, and weight equal, being $21\frac{1}{2}$ oz., and having the bows of the same form.



The trial gave 8 oz. in favor of B, since the superior speed of B required that weight extra to retard it to an equality with G. The stability of G, equalled $1\frac{1}{4}$ oz. The boat B, drew $\frac{7}{8}$-inch water at midship; F, drew $\frac{3}{4}$-inch; and G, drew $\frac{7}{8}$-inch; the respective weight of each being the same.

Seventh.

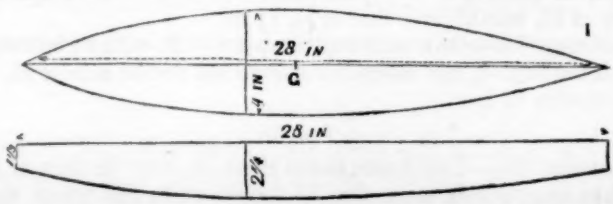
Experiment 71.—The boat C, being compared in speed with a boat H, of the same weight, and width of 4 inches; but in length 20 inches, having the bottom curved up as C.



The boat H, beat the boat C, by 12 oz.; H, requiring that additional weight to equalize their speed. The stability of H, was $2\frac{1}{4}$ oz.

Eighth.

Experiment 72.—The boat H, was compared in speed with a boat I,



of the same weight, namely, 33 oz., and width of 4 inches, but 28 inches long, having the bottom curved as H.

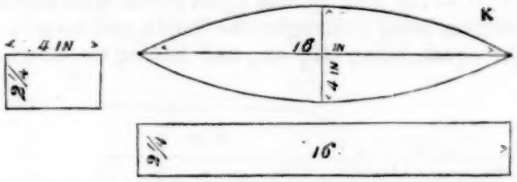
The trial gave the speed on the side of the boat I, and equal in weight to 24 oz. extra. The stability of I, was 2¼ oz.

Ninth.

Experiment 73.—The boat I, beat the boat E, before the angles were removed, by 32 oz. The stability of I, was 2½ oz., and that of E, 5¼ oz.

Tenth.

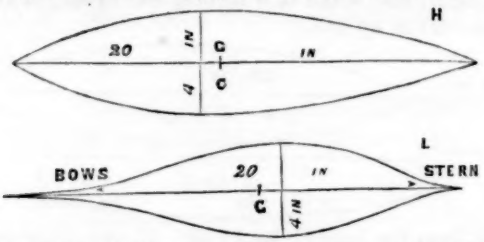
Experiment 74.—A boat K, 4 inches wide, and 16 inches long, having the midship section at the point of half its length, with the bows and stern alike, was tested against the boat C, but with bottom not curved up. The weight of each 20½ oz.



The boat K, beat in speed the boat C, by 2 oz., but its course through the water was much inferior to C; therefore, a piece of keel was necessary to remedy the evil. The stability of K, equalled 2¼ oz., that of C, 2 oz.

Eleventh.

Experiment 75.—The bird-shaped boat, H, being 20 inches long, and 4 inches wide, but not curved at the bottom towards each end, being quite straight, was tested against a boat of the form marked L; the length, width, and weight, the same as H, which equalled 22 oz.



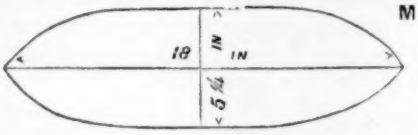
The trial of these two boats gave the speed on the side of H, with its bottom not curved, and to the amount of 4 oz. in extra weight, when the boat L, was drawn with its stern foremost; but when tested with its bows foremost, no difference was perceptible between them in speed. The stability of H, was 2¼ oz.; that of L, 1¼ oz.

Experiment 76.—On comparing the speed of H, with its bottom curved up, with the boat L, the difference was 12 oz. on the side of H, it being so far superior to L.

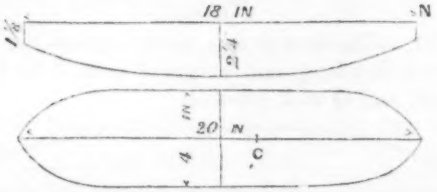
Twelfth.

Experiment 77.—Two boats, one of them, M, after the form of E, being 18 inches long, a trifle more than 5¼ inches wide, and which width was in this instance situated at the mid-length, with the bottom curved up to

the load-water line, commencing from the middle length, and terminating at each extremity; weight, 2½ lbs. The other boat, N, 20 inches long,



and a trifle more than 4 inches wide, sides parallel, but the bows the same in both, weight equal to M. This boat was also curved up from the mid length to each extremity.

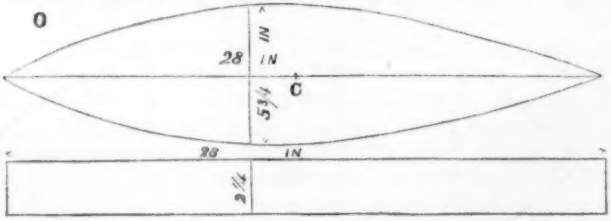


The result, upon trial, gave the speed 3 oz. superior on the side of M. The stability of M, equalled 6 oz.; that of N, 4 oz.

Experiment 78.—When the boat H was tested with the parallel sided boat N, their respective weights being 2 lb. 7 oz., the boat H, beat the boat N, in speed by the extra weight of 16 oz. The stability of H, equalled 2¼ oz.; that of N, 4 oz.

Thirteenth.

Experiment 79.—A boat O, of the bird shape, 5¾ inches wide, 28 inches long, weight, 2 lb. 5 oz., was tested in its speed against a boat also of the bird shape, 4 inches wide, 28 inches long; weight, 2 lb. 5 oz., and denoted in the preceding diagrams by the letter I. I, sank in the water $\frac{5}{16}$-inch, and O sank $\frac{1}{16}$-inch.

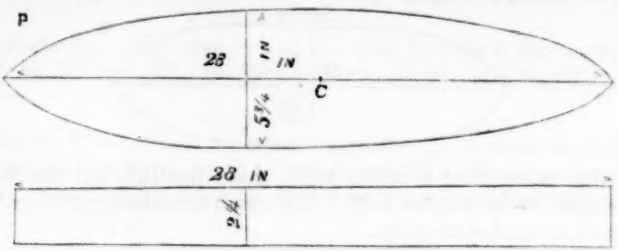


The result gave the speed on the side of I, in the extra weight of 12 oz. The stability of O, was 8 oz.; that of I, 2½ oz.

Fourteenth.

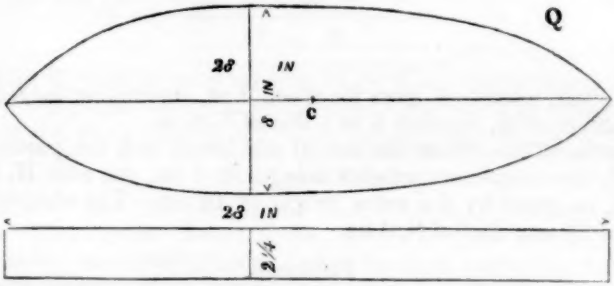
Experiment 80.—The boat O, was tested with a boat P, of a different form, but of the same width of 5¾ inches, 28 inches long; and weight of each, 3 lb. 4 oz. O, sank in the water $\frac{5}{16}$-inch; and P sank ¾-inch.

The boat O beat P, by 2 lb. 5 oz. extra weight. The stability of O, equalled $8\frac{1}{2}$ oz.; that of P, 12 oz.



Fifteenth.

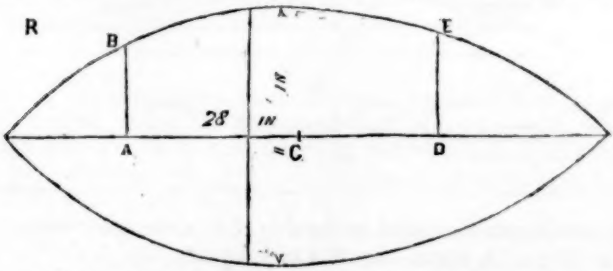
Experiment 81.—The boat P was tested against the boat Q, being 8 inches wide, 28 inches long, and weight of each, 3 lb. 4 oz. P, sank in the water $\frac{6}{8}$-inch; and Q sank $\frac{5}{8}$th-inch.



The boat P beat Q, by 20 oz. extra weight. The stability of P equalled 12 oz.; that of Q, 24 oz.

Sixteenth.

Experiment 82.—The boat Q was tested against the boat R, being 11 inches wide, 28 inches long, of the bird or duck shape, each weighing 5 lb. 1 oz. Q sank in the water $\frac{5}{16}$-inch; and R sank $\frac{3}{16}$-inch.



The boat Q beat the boat R, by 4 oz. extra weight. The stability of Q was 25 oz.; that of R, 29 oz.

Seventeenth.

Experiment 83.—The boat Q was again tested with a boat T, of similar dimensions, being 8 inches wide, 28 inches long, but each weighing 4 lb. 6 oz. Q sank in the water $\frac{3}{16}$-inch; and T sank $\frac{7}{8}$-inch.

The boat T beat the boat Q in speed, by 32 oz. extra weight. The stability of T equalled 16 oz.; that of Q, 24 oz.

Experiment 84.—This experiment was made to ascertain the law of the density of water with respect to bodies floating upon its surface, and the displacement they occasion. A tin vessel of a square form, and measuring 4 inches cube, was put on the water; and having first noted the displacement by its own weight, 2 oz. were then put into it, when their displacement was carefully marked upon one of the sides of the vessel. Another 2 oz. being added, the displacement was again marked; and so on to a third, &c., &c., up to 16 oz., altogether making, in the whole, eight divisions. Upon measuring the several divisions recorded, they were found all equal; consequently, showing that equal weights caused equal displacements.

(To be continued.)

On a New Mode of Measuring High Temperatures. By Mr. John Wilson, of Bridgewater.*

After referring to and describing briefly the pyrometers at present in use, the paper explained the method employed by the author to measure high temperatures. According to his plan, a given weight of platinum is exposed for a few minutes to the fire, the temperature of which is required to be measured, and then plunged into a vessel containing water of a determined weight and temperature. After the heat of the platinum has been communicated to the water, the temperature of the water is ascertained; and from this is estimated the temperature to which the platinum was subjected. Thus, if the piece of platinum employed be 1000 grains, and the water into which it is plunged be 2000 grains, and its temperature 60°, should the heated platinum when dropped into the water raise its temperature to 90°, then 90°—60°=30°; which, multiplied by 2, (because the water is twice the weight of the platinum,) gives 60°, that an equal weight of water would have been raised. Again: should the water in another case gain 40°, then 40°×2=80°, the temperature measured by the pyrometer. To convert the degrees of this instrument into degrees of Fahrenheit, we must multiply by 31·25, or 31¼. Thus, 80°×31¼, would give 2500° of Fahrenheit. And 60°×31¼=1875°. The multiplier 31·25 is the number expressing the specific heat of water as compared with that of platinum—the latter being regarded as 1.

In order to attain very accurate results by this method, precautions similar to those required in determining the specific heat of bodies must be taken; that is, it is necessary to guard against the dissipation of heat by conduction and radiation. The apparatus used by the author consists of a polished tinned iron vessel, of a cylindrical form, 3 inches deep and 2 inches in diameter; this is placed within a concentric cylinder, separated from the enclosed vessel about ¼-inch. By this means there is but little heat lost during the experiment, either by radiation or conduction.

At the commencement of the experiments, the author imagined it would be necessary to employ a considerable proportion of water, and

* From the London Journal of Arts and Sciences, July, 1852.

therefore took 25 times the weight of the platinum; but he found that the temperature gained by the water, even in cases of very high heats, did not exceed 4° or 5°—and an error of 1°, when converted into degrees of Fahrenheit, amounted to 400°. To obtain results within much narrower limits of error, it became obvious, a much smaller proportion of water should be employed; and ultimately it was found that double the weight of the platinum was in all cases sufficient.

There is no appreciable loss of heat from the evaporation of steam when the hot platinum is plunged into the water; there is probably no actual contact with the water until the platinum is fairly at the bottom of the water. It is in fact the converse of dropping water on a plate of platinum or iron strongly heated; in which case the water, instead of being suddenly dissipated as steam, assumes the spheroidal form, and runs about over the plate without coming in contact with the heated surface. It is only when the temperature of the metal becomes much reduced that the water is rapidly converted into vapor.

In ascertaining temperatures by this pyrometer, a correction has to be made for the portion of the total heat that is absorbed by, 1st, the mercury of the thermometer in the water; 2d, the glass bulb and stem of the thermometer; 3d, the iron vessel containing the water; 4th, the heat retained by the piece of platinum.

The portion of the total heat that is absorbed by these several bodies, compared to the portion received by the water, will be in proportion to their several weights, and the specific heat of each compared with water.

				Equivalent grains of water.
Mercury,	200 grains	× $\frac{1}{30}$th	specific heat =	7
Glass,	35 "	× $\frac{1}{6}$th	"	6
Iron,	658 "	× $\frac{1}{9}$th	"	73
Platinum,	1000 "	× $\frac{1}{32}$d	"	31
Total,	. . . . .			117

Therefore the effect of these bodies is equivalent to the addition of 117 grains to the 2000 grains of water,—or $\frac{1}{17}$th has to be added as a correction to all the temperatures obtained by this instrument; or, in other words, the multiplier must be increased from 31½ to 33 in this instrument, and in all similar ones where the weights of the mercury and glass of the thermometer, and of the iron vessel, are the same as stated above.

As the piece of platinum is the most expensive part of the apparatus, it is proposed to use a small piece of baked Stourbridge clay as a substitute for the platinum. The author has found, by experiment, that a piece of Stourbridge clay, 200 grains in weight, when heated to the melting point of silver, and plunged into the tinned vessel containing 2000 grains of water, raises the temperature of the water, 41°.

Now, if 1890° Fahrenheit (the melting point of silver) be divided by 41, we obtain 46° as the number corresponding to 1° of this pyrometer; and 46 will therefore be the correct multiplier; and no corrections are required for any heat abstracted by the thermometer, the tinned vessel, or the piece of clay.

The temperature of all sorts of furnaces and flues of steam engines, &c., may be readily ascertained by means of the piece of Stourbridge clay.

The chairman expressed the interest he felt in this new pyrometer that had been brought before the meeting, and considered it an ingenious and efficient instrument. He remembered having had a conversation with the late Prof. Daniell on the subject of his pyrometer, and expressing a doubt of the nearness of the approximation in the results obtained from that instrument; in fact, such delicate manipulation was required in using it, that it was scarcely available except in the hands of the inventor himself. But Mr. Wilson's instrument was so extremely simple in the construction and practical application, that an accurate measure of the quantity of heat could be relied upon, with ordinary care in the employment of the instrument. It might be theoretically considered, that quantity of heat was a different point from intensity of heat,—as in the case of voltaic electricity the difference between quantity and intensity was known to be so strongly marked in the different effects produced; and this pyrometer, although measuring correctly the relative quantity of heat required to melt different bodies, might give far from a correct measure of the relative intensity of different fires. However, the same theoretical question applied of course to the ordinary mercurial thermometer, which was also the standard of measure in this pyrometer, and to all thermometers which measured the degree of heat by the relative expansion of any body by heat, whether mercury, iron, or air.—*Proc. Mech. Eng., Birmingham.*

Remarks.—We do not doubt that for practical purposes, the very neat and simple process proposed by Mr. Wilson will be found very convenient and valuable; but for scientific accuracy, the loose establishment of equivalents will not answer, nor can the instrument be relied upon for delicate determinations, until the specific heat of platina at high temperatures shall have been determined; at present it is simply unknown. The pyrometer, invented by Prof. W. R. Johnson, used in the experiments on the explosions of steam boilers, by the committee of the Franklin Institute, and described in the *American Journal of Sciences*, vol. xxii, p. 96, and Report of the Committee, part II, p. 16, is analogous in principle, but far less convenient in practice. Ed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 16, 1852.

Samuel V. Merrick, Esq., President.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A communication was read from the Metropolitan Mechanics' Institute of Washington, D. C., informing the Institute of their organization, accompanied by a copy of their Constitution and By-Laws.

Donations were received from Messrs. A. S. Barnes & Co., New York; The U. S. Light House Board; Hon. Joseph R. Chandler, U. S. Congress; J. Amery, Esq., Boston; Messrs. John F. Frazer, Richard B. Osborne, W. H. C. Riggs, Charles E. Smith, J. A. Kirkpatrick, and the Pennsylvania Railroad Company, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of July.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (12) were proposed, and the candidates (13) proposed at the last meeting were duly elected.

On motion, it was

Resolved, That the Franklin Institute see with great pleasure the formation of a new Association for the promotion of Manufactures and the Mechanic and Useful Arts, in the City of Washington, and that they will do every thing in their power to promote its ends.

Resolved, That the Corresponding Secretary be directed to communicate this resolution to the Metropolitan Mechanics' Institute.

Dr. Rand, Chairman of the Committee on Meetings, presented to the meeting a model of an improvement in Carriage Axles, invented and patented by the Rev. Kingston Goddard, of this City. The nature of this invention consists in making the box in two or more parts, with a recess to receive and embrace a collar on the journal part of the axle, or what is essentially the same, with a projecting fillet to fit into a recess in the journal part of the axle, when this is combined with the mode of securing and holding the box on the axle, by making its periphery conical, to fit and be drawn into the hub, or into a pipe-box fitted to the hub, so that by simply securing the box within the hub or pipe-box, the axle is at the same time secured within the box. The advantages claimed for this arrangement are to be found in the ease and regularity of motion produced, the perfect safety of the apparatus, its retention of oil, with facility of cleaning and repair.

Dr. Rand also exhibited a piston of a steam cylinder, which had been received from Mr. M. W. Baldwin, and which was so much corroded as to be ruined by the action of rosin oil, which had been used upon it as a lubric. Dr. R. remarked, that in preparing this oil by the destructive distillation of rosin, a large amount of pyroligneous acid was formed, and it was undoubtedly to this that the corrosion was to be attributed. Mr. Greble had informed him, however, that he had used a rosin oil on a large shaft running through a cellar, and had found that it did not gum, nor corrode the metal, while it remained fluid at temperatures at which other oils became stiff. The difference in the oils was due to the care used in their preparation, and the pains taken to separate completely the pyroligneous acid.

Dr. Rand called the attention of the members to the interesting results of some experiments on the strength of sheet iron and copper, made by Mr. Joseph Harrison, Jr. The sheets were confined between two hemispheres, into the lower of which water was forced; the deflection was measured by means of a rod passing out through the upper one. A sheet of copper, full $\frac{1}{32}$-inch thick, at 532 pounds to the square inch, was not bursted, but had assumed an uniformly dome-shaped form, as perfectly as if stamped with a die, and was much drawn at the bolt holes; the deflection in the centre was $2\frac{1}{10}$ inches. A sheet of Russia sheet iron, $\frac{1}{32}$-inch scant, at $84\frac{1}{2}$ pounds became also dome-shaped, and burst at a flaw

nearly midway between the centre and circumference, the deflection at the centre being $\frac{3}{4}$ of an inch full.

Mr. James Young, Printer, of Philadelphia, exhibited an Anti-Friction, Self-Acting Press, for book, job, and card printing, and made the following remarks upon it:

This press is anti-friction in the same sense as Dick's anti-friction press, and self-acting in the same sense as the self-acting cotton mule. Its advantages generally over any other press consist in its greater power, better adaptation of the lines and position of the metal to bear greater strain, with a less weight of metal in the whole machine than any that has yet appeared for type printing. It is simpler in construction, having fewer pieces than a hand press with rolling or inking apparatus attached; it has a "throw-off" so constructed as to throw off the impression at the last moment before actually giving the pressure; it has also an improvement in distributing the ink, and of self-action in unfastening and fastening the form solidly in a moment, without screws or wedges. The sheets can be fed on the press at any desired angle between 45° and a horizontal line; the pressure on the nippers that hold the sheet can be regulated at will. A further description and engraving of the press will be given when patents have been secured in Europe.

Mr. Aldritch Moore exhibited A. S. Macomber's Patent Feed Cutter. In this machine the frame that holds the knife is of cast iron, and is fastened to the front posts by screws, with a projection for boxes, in which the ends of the cylinders are placed. There is also another projection, with a mortise, into which the knife is placed, and confined by means of screws at both ends; there is also a screw at each end of the back of the knife, intended not only to hold the knife from moving back, but also to move it forward as it wears. The cylinders are of cast iron, with spiral flanches of any desired number. The cylinders are so placed that the flanches of the upper will play as near the centre of interval between the flanches of the lower as possible. The flanches, when revolving, act as feeders, and draw the article to be cut in contact with the edge of the knife, where it is cut. The knife may be sharpened by placing a little emery and oil on the flanches, and turning the machine back, the knife being at the same time started forward by the set screws. This machine claims the advantages of greater simplicity and ease of operation; having but a single straight knife, it is easily kept in order. It has been applied for cutting paper and rags, as well as feed, and has been found to answer admirably.

Dr. Kennedy called the attention of the meeting to an improved Ear-piece for Acoustic tubes. These tubes, by which communication is maintained between different apartments in hotels, factories, stores, offices, &c., were coming into very general use, and were even supplanting the door and servant bells in dwellings. Formerly, it had been necessary to put up a line of bell-wire with bell attached, parallel with the tubes, to call the attention of the individual addressed; such had been the arrangement in the late Barnum's Museum in this City. Messrs. Woolcocks & Ostrander, of New York, have removed all necessity for a bell, by placing a whistle in the ear-piece, which utters a shrill sound whenever the tube is blown through from the other end, and thus warns the hearer. The whistle

blocks up the bore of the ear-piece, wherein it is kept by a spring, and from which it may be displaced by depressing a small lever on the outside, leaving the calibre free for conversation. A small hinge-valve, which covers a lateral orifice in the ear-piece, is thrown up by the force of the breath in whistling, and remaining elevated, gives further assurance that a hearing is demanded. The expense of these tubes is but little if any greater than bell hanging. The articles exhibited came from Mr. T. Butler, tin and copper smith, Seventh street, a few doors from the Institute, who would furnish tube at $3 per 100 feet, and patent ear and mouth-pieces at from $2 to $2·50 the pair.

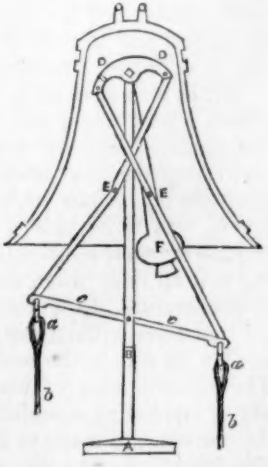
Dr. Kennedy also exhibited specimens of French Enamelled Ware, from the house of M. Engler, 128 Rue Vieille du Temple, Paris. The enamel covered the inner and outer surfaces of the iron vessels, which were not cast, but stamped. Stamped vessels of tinned and of enamelled iron were stated to be in common use in France, where they were fast taking the place of the ordinary grooved and soldered tin-ware. The absence of sharp angles and crevices, which retain dirt, gave the former a great advantage on the score of cleanliness. Dr. Kennedy further said, that the business of enamelling iron was fast assuming importance on the Continent. He had seen in the National Porcelain Manufactory at Sevres, near Paris, vessels fashioned of iron, covered with porcelain, and most elaborately ornamented. The expense of enamelled culinary articles was but slight; he had bought at the establishment above mentioned an iron saucepan of the capacity of a quart, and enamelled on both sides, for 1¼ francs (about 24 cents). The saucepan was so thin that it could be heated over a spirit-lamp like an evaporating basin, and had been used in his laboratory for several months, subjected to the action of acids and fatty matters, without perceptible injury to the enamelling. Signs perfectly indestructible by ordinary wear and tear are made of enamelled iron. These are frequently seen on the mile posts and *grade indicators* of European railroads; also at the corners of the streets of cities, bearing the names of the streets. A street sign, about 25 inches (63 centimetres) long, with a row of three-inch letters, is furnished at five francs. Breast-pins, plant labels, tomb tablets, and a host of other articles of beauty or utility, are cheaply supplied by the skill of the French enamellers.

A Dioptric Apparatus of Fresnel, of the first order, furnished with a cupola and lower zones of catadioptric rings, made by Le Paute, of Paris, for the light-house on Carysford reef, Florida, had been put together under the direction of Lieut. George Meade, of the corps of the United States Topographical Engineers, and the members of the Institute were kindly permitted by him to view it. The eight panels of the central belt consist of four annular lenses and four cylindrical elements, which revolve around the light in the focus as a centre, presenting the vertical bar of light which characterizes the fixed light visible in every azimuth, the annular lenses interrupting in their revolution the *central portion* of this beam of light, and concentrating it in one great flash of intense brilliancy. By the revolution of the central belt, a single annular lense in it produces a similar, and even a better effect, than the vertical cylindrical element revolving around the drum of the fixed light apparatus heretofore in use. It is, moreover, more simple, less weighty, and intercepts less light,

inasmuch as one lense is substituted for two. It was explained to the meeting by G. W. Smith, Esq. The four wick lamps, he stated, were expensive, complicated, and occasionally, though very rarely, liable to derangement, and required some skill to repair them. In England, the mechanical lamps have been superseded by a common fountain or vessel of oil placed above, provided with a tube, conveying the oil to the burner; an intermediate regulating reservoir, provided with a floating ball, gives the requisite supply. In France, moderator lamps, so called, have lately in some instances been substituted; they consist of a heavy loaded piston, which is perforated, and by its pressure in descending, forces up the oil through a tube to the level of the burner, and receives the overflow on its upper surface. This lamp, however, is defective in principle, from the varying height of the column of oil, and on that account was rejected by Mr. S., who invented the same some eight years since. A piston moving horizontally in a box, the pressure being applied over a pulley by a weight descending vertically, will of course sustain a column of uniform height, and therefore of uniform resistance; this plan of Mr. S's., he deemed preferable to the moderator, but still he thought the fountain to be superior to either for light-house lamps, although his arrangement of the horizontal piston is very suitable for domestic lamps.

Mr. S. proceeded to state that a careful examination of the screw pile light-house, on the Brandywine Shoal in the Delaware Bay, had shown that it had successfully resisted the ice of the last three years without sustaining injury, and last winter it was repeatedly assailed by vast masses; he was happy also to inform the meeting, that the iron pile light-house on Carysford Reef, had resisted all the storms since its erection, and especially the late tremendous hurricane.

Mr. Thomas A. Stran, of New Albany, Indiana, exhibited to the meeting a model of his Apparatus for Ringing Bells, which will be understood by a reference to the accompanying figure.



The pedestal, A, and upright shaft, B, and lever, C C, and lever, D D, and compound lever, E E, and bell clapper, F, may all be made of cast or wrought iron, or other metal. The pedestal, A, may be made any suitable length and breadth, and fastened to a suitable beam by means of screws and bolts, to sustain the upright shaft and combined fixtures for ringing the bell. The shaft, B, is made of any length that may be desired to suit the position or situation of the bell.

The levers, C C and D D, and the compound lever, E E, must necessarily be governed in their length by the size and dimensions of the bell. The links, *a a*, are for the purpose of attaching the bell ropes, *b b*.

Mr. Stran claims for this arrangement the advantages of simplicity and cheapness. The bell being stationary, the jarring to the building is prevented; the utmost

precision in ringing can be attained with but a slight exertion of force. The bounding of the clapper is prevented, and thus one great cause of the breakage of bells avoided.

Frederick Graff, Esq., the Superintendent of the Schuylkill water works, being present, Mr. Smith stated that for eight years past, he had been engaged in examining the amount of sediment held in suspension in that water as delivered in the city; he had made in that time, nearly four thousand experiments with a porcelain cylinder, into which the water was daily poured, allowing it to remain undisturbed for a given period, and then examining the amount of sediment. The general result, which is all that he would present to the meeting, was, that the amount of deposit was much greater than was usually supposed, and that even under the most favorable circumstances, when the water was in its best condition, the deposit was always perceptible within the first six hours from the commencement of the settling, and in many cases continued to settle even for forty-eight hours. The reservoirs on Fairmount are of but limited dimensions, and cannot be used advantageously for subsidence. It will scarcely be credited in the cleanly City of Philadelphia, that these reservoirs, some of which are nearly forty years old, have never been cleansed until the present year. Mr. S. briefly described the disgusting nature of the deposit that had been removed, and the sources whence it had been derived; that in fact, the only reservoirs of subsidence were the stomachs of the citizens of Philadelphia; he was astonished that they had not long since revolted at this impurity. He described an ingeniously contrived reservoir of subsidence, devised by J. Price Wetherell, Esq., similar in principle, though larger in scale, to that used by him in his white lead factory, and regretted that his liberal offer for constructing the same had not been accepted by the Councils of the City. The Cities of New York and Boston possess great advantages over us, in the fact that their supply is not drawn from a turbid river, but from large, deep, and pellucid lakes. Mr. Graff stated that the chemical analysis showed that the water of the Schuylkill was as pure as that of the Croton, or of the Cochituate, which Mr. S. admitted, provided it was previously filtered, but not otherwise.

Mr. S. also gave an account of an apparatus for economizing the heat which is now totally lost by the use of foul air flues for ventilating rooms; the common respirator some dozen years since, gave him the first idea of recovering the heat from the warm air now uselessly expelled into the atmosphere. A box packed with metallic wire gauze in numerous parallel layers, was to be placed in the foul air flue, in which it would soon acquire the same temperature; a similar box was to be placed in the adjoining foul air flue; when the first box had acquired the necessary elevation of temperature, the effluent valve was to be closed temporarily, and the cold air from without made to pass by a similar valve through this heated box on its way to the main heating apparatus, to be still further heated. The inconvenience of this apparatus would be twofold; first, the necessity of employing machinery or attendants to work the valves by which the currents are made to alternate from one box to the other, as they are alternately hot and cold; second, the inconvenient, unpleasant, and unhealthy deposit of moisture on the cold metallic surfaces in the box, from

the effluent foul air, which moisture would be again introduced into the room on the change of the current of air; he therefore modified this plan, by the introduction of a number of pipes into the fresh air flue from without, which pipes would convey the foul air to the external atmosphere, without permitting any mixture of air to take place in the flue, and which would be sufficient in extent of surface and in number to absorb all the *available* heat of the effluent foul air; where mechanical forcing machinery is not employed, sufficient heat must be left in the air to insure its ascent, and thus to ventilate the apartment. The condensed water would be from time to time drawn off from the lower part of the tubes without mingling with the fresh air on its passage to the main heater.

Mr. Jacob D. Sheble exhibited several forms of the stereoscope, very simple, cheap, and portable, with a diaphragm, which he stated enabled persons who could not readily adjust their eyes with the ordinary stereoscope, to use them with facility. The common reflecting pseudoscope was also exhibited by him, very cheap in its construction.

BIBLIOGRAPHICAL NOTICES.

The Model Architect,—containing original Designs for Cottages, Villas, Suburban Residences, &c., accompanied by Explanations, Specifications, Estimates, and elaborate details. Prepared expressly for the use of Projectors and Artizans throughout the United States. By SAMUEL SLOAN, Architect. Philadelphia: E. S. Jones & Co. 1852.

We have delayed reviewing this interesting publication until the completion of the first volume, now before us, as there is generally much inequality in the contents of such works, and it is necessary to examine many numbers before it is possible to form a correct opinion of their average value, and a careful examination of this work has strongly confirmed this opinion; the designs are of very unequal merit; with many of them we have been exceedingly pleased; the general arrangement of the cottages, villas, &c., is exceedingly picturesque, ornate, without meritricious adornment, and the plans combine the best modern improvements and conveniences, without the necessity of extravagant expenditure. While there is, however, much to gratify the eye, and satisfy the judgment of the architectural critic, we reluctantly perceive a few of the designs which do not manifest purity, either in their masses or details; it is true, that a certain latitude or license is allowable in private residences, where even the caprices of the proprietors are at least tolerated by the public taste; a more rigid adherence to rule is expected in urban buildings, but especially if they be public edifices. It is very difficult to draw the fine line of demarcation between commendable originality and servile adherence to precedent, an adherence which is the bane of genius, and which in its very essence, is hostile to all improvement, an incubus which forbids the genius of architecture to soar into the regions of the untried, or to display the beauties resulting from novelty and invention; yet this adherence is what

specially has characterized the architecture of the last three centuries. The architect has been compelled to walk in the same wearisome, monotonous round trodden by his predecessors, and to be trodden by his successors, if the purists are to remain in the ascendant. The decree has gone forth from them, that the fashion is to be as immutable as in the days of the Medes, and that a building is to be pronounced without the pale of fashion, and therefore of endurance, unless it be a fac simile of those that have preceded it. We read much in the æsthetic school of rigid transcendentalists, of the great and by them styled eternal principles which should govern architectural composition; it is true that a few such great principles unquestionably exist, and can be easily demonstrated, but their number is much less than the purists would wish us to believe. After all, mere fashion has nearly as much to do with architecture as with dress, furniture, and articles of virtu; and the great latitude which has been allowed in these latter, in all ages and countries, has only been less tolerated in the forms displayed by architecture from the more permanent character of the materials, and the consequent impossibility of frequent capricious changes. Nearly a thousand years ago, the Romanesque, Byzantine, and Lombardic, gratified our ancestors, wholly regardless of the classic schools of Greece and Rome; a few centuries later, the mediæval pointed began to aspire towards heaven, disdaining the low and long horizontal lines of Greece; change followed change so rapidly that scarce two buildings could be found with identically the same features, and the last expiring school of the pointed style bore but a feint resemblance to its early predecessors. The Cinque Cento and Renaissance soon superseded the pointed mediæval, which remained in a state of suspended animation until the present generation have disinterred and endeavored to resuscitate it, with what success, the majestic fane of Trinity Church, New York, towering to the skies with a grandeur and a purity as yet unsurpassed by any edifice erected in that style since the first settlement in the United States, may attest.

The ancient Roman school next attracted the universal approval of Christendom, until Stuart and Revett presented the still more ancient claims of Greece, when an eruption of pseudo Greek buildings, which would have astonished an inhabitant of Attica, began to deform, and in a few cases to beautify the civilized world. The Greek mania has now greatly subsided: the straight jacket has been removed, and edifices built mainly according to Greek principles, without a too servile adherence to their forms or details, and invested with all the improvements of a modern civilization which the Greeks never knew.

A new era at length arrived; the moderns, repressing their inventive faculties, were content, after the manner of the much ridiculed Chinese, merely to copy; and after an age or two, wearied with the monotony of one school, resorted to the scarcely less irksome task of copying another; until at length a glimpse of returning reason led them to perceive that much, if not equal beauty might be found in the schools of widely separated eras. The present taste is more cosmopolitan than in any previous age of the world. We may find in one and the same city specimens, or intended to be such, of each and all the eras which we have previously named; but all copies, with scarcely an attempt at originality; nay, we

have even seen a design by a soi-disant architect, combining them all in one and the same building—a vision doubtless revealed to him in a nightmare, and eminently calculated to produce one in the spectator. Indeed, were a building to arise, graceful in its form, harmonious in its proportions, and exquisite in all its details and accessaries, and strictly conforming to the few generally received cannons of beauty, but without an adherence to the mere conventionalities of the schools, we very much doubt, nay, we do not doubt at all, whether it would not be denounced as a monster, and its designer charged with intolerable presumption, and inordinate self conceit. In applying these remarks to the book before us, our readers may perhaps praise the very non-adherence to precedents, which Mr. Sloan has exhibited by his non-adherence to purity in some of his designs, although we must confess, that the stays of our grand-mothers, and the cocked hats of our grand-fathers, as parts of the dress of one individual, seem somewhat unfashionable, even if they be not irreconcilably incongruous; we hail, however, the appearance of this, as of all similar works, for the diffusion of the knowledge of architecture among our almost untaught people. The plates are well executed, the explanatory letter-press written in a plain, agreeable style, and we trust the work will long be continued, and meet with increasing patronage.

G. W. S.

Blatchford's Circuit Court Reports, Vol. I. By SAMUEL BLATCHFORD. Auburn, Derby & Miller, 1852: Philadelphia, T. & J. W. Johnson.

The above is the title of the first volume of Reports of Cases determined by Mr. Justice Nelson, with the Associate Judges Betts, Conkling, Prentiss, and Judson, in the several United States Courts for the Second Judicial Circuit, (New York, Connecticut, and Vermont.) The work is here noticed because it is deemed of great value to patentees, patent solicitors, experts, and scientific mechanics. It contains decisions of Mr. Justice Nelson upon one hundred and eleven points of patent law and practice, a more numerous and important collection of adjudications upon this branch of Law than can be found in any previous volume of Reports. The great reputation which Judge Nelson has acquired in patent cases renders the opinions contained in this volume of the highest authority. The cases here reported involve questions arising under the latest amendments of the patent laws—questions as to what constitutes patentable invention—what acts amount to an abandonment of an invention—invalidity of re-issued patents—jurisdiction of Circuit Courts over infringements committed out of their districts—evidence—account—injunction and damages, &c. An interesting opinion is also reported in a case arising under the act granting patents for designs, (the first reported case we believe under that act;) and another on the much debated question of the right of defendants to an issue or jury trial, in suits for infringement brought upon the Chancery side of the Court. The Woodworth patent, the Blanchard gun-stock patent, Allen's gun-lock patent, and Wolf's car wheel patent, are explained, commented upon, and their limits defined. The able arguments of counsel in the great case of Wilson *vs.* Rousseau,